VOL. XVIII. No. 12 DECEMBER 1933

MECCANO MAGAZINE



A RED INDIAN FEEDS HIS BEAVER FRIEND
(see page 930)

6D.

THE FROG INTERCEPTOR FIGHTER



Have you joined the FROG Club? Ask your dealer for entry forms, or write to us.

. . . see how it flies

THIS machine *really is* to scale, the photograph is genuine and the machine is not touched up in any way.

The FROG is the only representative scale model made that really flies off the ground with a rapid climb.

Here are its unique points, not approached by any other machine:—

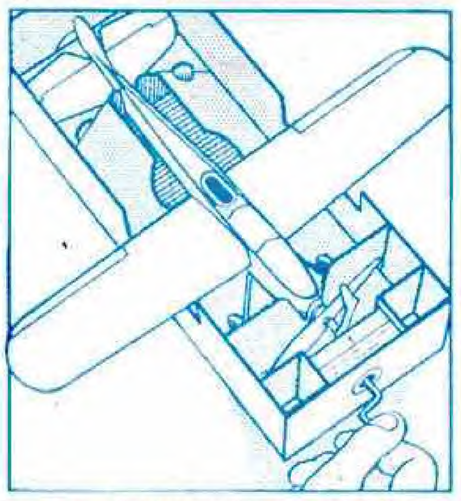
OVERALL LENGTH - 9½ ins.
WING SPAN - - - - 11¼ ins.
NORMAL FLYING SPEED 650 ft. per min.
LENGTH OF FLIGHT 300 ft.
HEIGHT OF FLIGHT 70 ft.
SCALE - three-eighths in. to 1 ft.

SCALE PERFORMANCE: The propeller is correctly speeded up by accurately cut gearing, so that the airscrew is correctly to scale without sacrificing correct scale performance (scale speed of 236.36 m.p.h.)

'CRASH PROOFNESS': No machine, large or small, can withstand every form of abuse, but the FROG stands a wonderful amount, owing to its special design and aluminium alloy fuselage. The main planes, undercarriage and 'gear box,' for instance, are so attached that on encountering any substantial obstruction they detach instead of breaking. The machine in the photo had been crashed a dozen times. Spare parts are accurately interchangeable.

EVERY ONE TESTED: Each model has to 'take off' with a short run, climbing to clear a set obstruction before it is passed.

AEROBATICS: Loops and other stunts are easily arranged.



NO TEDIOUS WINDING

One of the many features patented in all manufacturing countries is the special geared-up winding device built into the FROG'S box, by which it can be fully wound for flight in 15 secs.

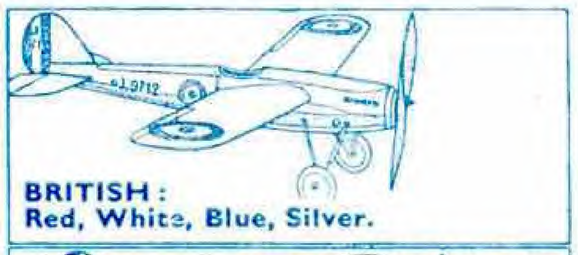
Price, including box with geared-up winder, winding handle, motor lubricant and fixture, gearing lubricant and full instructions - - - **7/6**

Obtainable at all Sports and Toy Shops. In case of difficulty write to Sole Concessionaires:

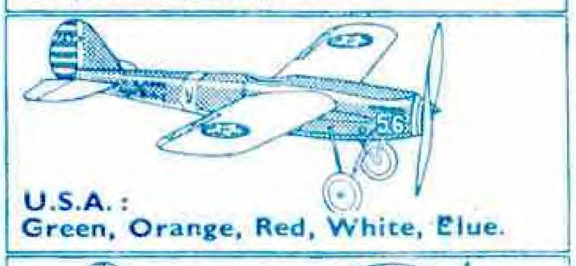
LINES BROS. LTD TRIANG WORKS, MORDEN ROAD, MERTON, S.W.19

British made by International Model Aircraft Ltd.

THE FROG IS MADE IN THESE NATIONAL COLOURS



BRITISH: Red, White, Blue, Silver.



U.S.A.: Green, Orange, Red, White, Blue.



FRENCH: Dark Green, Red, White, Blue.



ITALIAN: Red, White, Green, Pale Yellow, Blue.



DUTCH: Blue, Crimson, Silver, Grey, Pale Yellow



ARGENTINA: Silver, Pale Blue, White, Gold.

BELGIAN: Red, Black, Yellow, Silver. As shown in photo.



The **PUSS MOTH**
de Havilland Monoplane
18 in. span: height of flight 100 ft., length of flight 600 ft. **17/6**

FROG

MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool 13
England

Vol. XVIII. No. 12
December, 1933

With the Editor

Christmas Greetings to all Readers!

The months have flown quickly by, and once more the time has come to wish a Merry Christmas to all my readers. As the "*M.M.*" is published on the first of each month, my greetings necessarily come some time before Christmas, but I hope every reader will remember them on Christmas morning. I am already looking forward to the shoals of cheery letters that always pour in during December and January from readers in all parts of the world. These letters are a source of infinite pleasure and encouragement to me and to my staff, for they show that our old friends are still faithful to the "*M.M.*," and that year by year we are gaining large numbers of new friends. The world is full of troubles and anxieties, but the spirit of youth still retains its splendid enthusiasm.

The Wonderful Progress of the Magazine

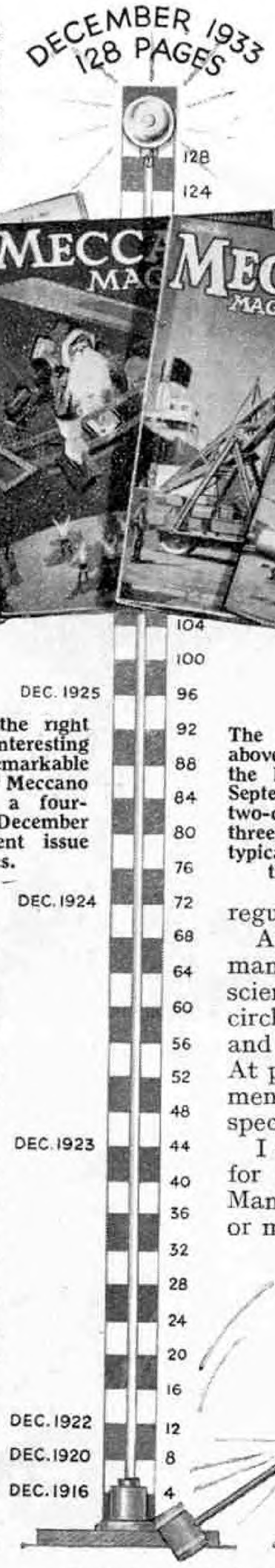
This issue forms a great landmark in the history of the "*Meccano Magazine*," for it contains 128 pages, that is 16 pages more than any previous issue! The story of the magazine is a wonderful and unique record of progress. The first issue appeared in September, 1916; it consisted of only four pages, and was given away free. By 1922 it had grown to 12 pages, and a year later it reached 28 pages. In May, 1924, it appeared in the first of the series of coloured covers that still form one of its most striking and individual features. A further increase to 52 pages took place in the following year, and since then it has grown steadily both in size and circulation, its net sales now being over 70,000 copies per issue.

To-day the "*M.M.*" is to be found in every civilised country in the world, and it forms a link, not only between Meccano boys, but also between all boys who are interested in the wonderful world around them. It is universally recognised as the boys' magazine of engineering—the only one of its kind in existence.

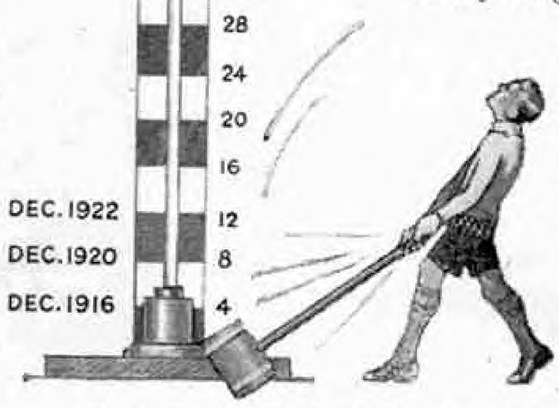
Ninety thousand copies of this month's 128-page issue have been printed, and it is interesting to try to realise what all these copies would look like if they were placed together. If they were all piled up one on top of the other, the pile would reach the enormous height of 1,250 ft. This is nearly three-and-a-half times the height of the cross on the dome of St. Paul's Cathedral, London, and actually 2 ft. more than the height of the Empire State Building in New York, which is the tallest building in the world! If the 90,000 copies were laid out end to end they would extend for nearly 15½ miles; and if the issue were printed on a paper ribbon of the width of a page its length would be over 2,025 miles, or practically five times the length of the journey by the London, Midland and Scottish Railway from London (Euston) to Glasgow. The total weight of the paper used is over 26 tons, and the actual printed surface amounts to 164 acres.



The group of "M.M.'s" above shows, reading from the left, the first number, September, 1916, the first two-colour cover, the first three-colour cover, and two typical examples of recent three-colour covers.



The diagram on the right shows in an interesting manner the remarkable growth of the "Meccano Magazine" from a four-page issue in December 1916 to the current issue of 128 pages.



December 1933 rings the bell!

My Plans for 1934

During the coming year I do not propose to make any great changes in the general contents and arrangement of the magazine. All the regular features will be retained, as the steady growth in the circulation of the paper proves beyond doubt that these are of widespread interest to the world of boys. Occasionally during the past few years pressure on space has obliged me to omit one or other of these features from a particular issue, and whenever this has been the case I have received a deluge of letters f protest from all parts of the world! One new feature that I hope to introduce is a section devoted to motor transport, for which there is evidently a great demand. This section will deal with the latest developments in motor vehicles of all kinds, with new records and other striking achievements, on somewhat similar lines to the existing regular pages on aviation, railways and general engineering.

Apart from the regular features, we have in active preparation many articles of outstanding interest on engineering and scientific topics. We keep in close touch with engineering circles, not only in the British Isles, but also in foreign countries, and there are pending some developments of remarkable interest. At present I am not able to reveal the nature of these developments, but when the time comes I shall deal with them in special articles, fully illustrated.

I take this opportunity of reminding readers that suggestions for the improvement of the magazine are always welcome. Many of its most popular features have been either introduced or modified as the result of such suggestions, and I am always ready to give the most careful consideration to new ideas.

The figures given earlier on this page, together with the accompanying diagram, show clearly the remarkable growth in the magazine; but during 1934 it would please me enormously to see even further progress. In this, readers can help greatly by telling their friends about the "*M.M.*," and by lending them an occasional copy so that they can see for themselves its interesting contents. I shall do my utmost to make the magazine more attractive than ever, and I would ask every reader to help by securing at least one new regular subscriber.

Grey Owl and His Beaver Friends

A Romance of the Canadian Wilds

FAR up in Temiscouata county, in the wooded wilderness of Quebec, runs a small stream through the heart of the woods. Nestling on its banks stands a small cabin, the home of Grey Owl, former scout, hunter, soldier and trapper, but now an apostle of the gospel of conservation, who has dedicated his life to the protection and propagation of the wild life of Canada.

Grey Owl's life history is as romantic as it is unusual. Born about 42 years ago, he took part from his earliest youth in the life of a plains Indian, trapping and hunting with the braves. His father had served as a Government scout at Fort Laramie, in Wyoming, under Colonel Cody, better known as "Buffalo Bill"; but the injustice and unfairness of the wars against the Indians eventually drove him to retire from the work.

Subsequently Grey Owl signed up with Buffalo Bill for a European circus tour. Soon tiring of this life, however, he heard the call of his ancestors, and the longing for the soft leaf-strewn forest paths and the wooded waterways brought him to Canada. Taking to the bush life, he found time to engage in the famous Cobalt Silver Rush of 1907, but gave this up for his vocation of trapping and hunting. He was formally adopted by the Ojibway Indians, and married Anah-Ar-Eo, an Ojibway maiden, and together they travelled the wilderness with the same enthusiasm and understanding of nature. The girl is fairly well educated, but although they both speak English proficiently, they find it more pleasant to converse in their native tongue.

In a period of about six years they covered by canoe over 2,000 miles, with Grey Owl trapping, hunting, and acting as guide in turn. The outbreak of the Great War brought him in from the woods to enlist, and after acting as a scout instructor in England for several months, he saw nine months' active service with the 13th Montreal Battalion as sniper. He was wounded twice and invalided out in 1917, when he returned to Canada and went back to the traplines. Then followed three years of wanderings through the waterways of Ontario and Eastern Quebec in a search for hunting grounds left unspoiled by the invasion of get-rich-quick trappers, who have denuded this part of the country of game by a most ruthless slaughter.

About 10 years ago the restrictions on the taking and sale of beaver pelts were lifted by the Government. During the long closed season, which had existed for several years, the beaver had regained much of their original numbers, and the lakes and forest streams of Ontario and Quebec were peopled by millions of these animals. Every creek and pond had its colony, and many inland canoe routes owed their navigability to their dams. The removal of the restrictions led to a greed for easy money, and there began a slaughter something like that which led to the extermination of the bison. Greed and increasing competition led to a ruthlessness in methods of destruction that could only be described as savage.

The devastation of the wild life in the different sections through which he had travelled had gradually brought home to Grey Owl the fact that soon a hunting-ground would be a thing of the past. The practical extinction of the beaver, the pelt of which was regarded as the "coin of the realm" by the country's early settlers, was the ultimate reason for his momentous decision to forsake the chase and become instead a protector of wild life. In relating his experience Grey Owl says :—

"During 1926-27 and 1928 I travelled around 2,000 miles by canoe, looking for a hunting-ground, stopping wherever winter caught me, and found nothing much except a lot of other fellows doing the same thing. I spoke with not one, but hundreds of Indians, and it was always the same tale—no fur! I passed through whole reaches of country, 100 miles perhaps at a time, without seeing any signs of fur except foxes and rabbits. It seems incredible that the animal population of so vast an area could be exterminated in so short a time. But remember the buffalo—they were killed off in 10 years, the last 3,000,000 in four years! The beaver disappeared suddenly like the blowing out of a light. Where are the caribou of Eastern Canada?

"These things go on behind the scenes. The trap and the rifle and poison are working on the inside like decay in a hollow tooth, and in the same manner







(Top) A baby beaver asleep on Grey Owl's shoulder. (Left and Right) Grey Owl feeding his beaver friends. All the photographs used in this article were taken in Riding Mountain National Park, Manitoba, Canada.





some day, unexpectedly, will come the end. The banding together of scattered remnants in some districts creates a fictitious appearance of large numbers. To-day they appear to be plenty; you turn your head, and when you look again they are gone. That is all. And as the other species went, so the rest are apt to go just as suddenly. In a place where I used to bring out 40 mink before New Year the villages are now in want."

Carrying out his resolve to abstain from trapping, save for the necessities of life, Grey Owl cleared the woods around their snug little cabin, and by the side of the stream devoted his time to more peaceful pursuits. How he came to study and tame the beaver is a story all in itself.

A mother beaver had been trapped, leaving behind the young brood only a few weeks old. A young beaver at any time is a very delicate animal, and realising that death would claim the whole brood if left to shift for themselves, Grey Owl and his wife took the young amphibians under their care. The beaver rapidly became very tame, would come quickly at a call, eat food right out of hand, and follow about camp like domestic pets.

Grey Owl tells of first-hand experience with these little creatures of the woods, that gives a wonderful insight into the life and habits of the beaver. A year or so ago he captured a young beaver, one of a pair the other one of which had died, and brought him to the small lake near his camp. The little animal refused to remain wild, however. "His whole short life of four months had been turned topsy-turvy, inside out, high west and sideways. He had been transported hither and thither on trains and wagons, carried long distances in a box on his owner's back, and had finally spent two entire days in an empty stove. For a swimming pool he had a dishpan, and instead of poplar he was fed on pancakes. Constant companionship with man from infancy, and the task of adjusting himself to the somewhat erratic hours I keep, had completely upset his equilibrium. And now suddenly had come the end of a very eventful journey, and all was peace and quietness and contentment. A lake with enough water for birling like a spinning log, and diving to his heart's content; any amount of mud in which to play and build small fantastic imitation beaver houses on the shore; and a long burrow with a roomy sleeping apartment left by some long-gone family of his kind, spelled for him a happiness he had never before known.

"In the creek that feeds the lake I had fixed up an old beaver-house, placed a quantity of feed, and turned him loose. But he did not want to be loose. Every night before the ice came he was at the camp door at dark. He was by no means the first homeless kitten beaver that had fallen into my hands, and his predecessors who had all survived their delicate infancy had seemed imbued with the idea that life was a huge joke, and were mischievous to a degree. But he was all alone and seemed to miss his small companion that was gone, and had none of the light-hearted deviltry of his forerunners.

"He was a sad little creature as he sat forlornly on the floor. Who knows but that in his wee brain there was not some dim recollection of happy days of romping and tumbling with just such another clumsy ball of fur, in the deep cool grass along the riverbank? And sometimes as he regarded me gravely, sitting on my feet the while, my heart went out to the little waif that did not want to be free, and I would pick him up and pass my hand over the rich fur. And he would sigh contentedly and immediately fall asleep, to dream of cool waters and mud, of poplar leaves and pancakes."

When the freeze-up occurred he took up his residence in the cabin, in which Grey Owl had constructed a sort of imitation beaver house with a tin tank for a swimming pool. Here he lived contentedly all winter, revealing a sagacity, mischievousness and sense of fun that were often almost human. Later another young beaver, found wounded and half-drowned and nursed back to the enjoyment of life by Grey Owl and his young wife, was added to the domestic circle. But with the coming of spring both animals were returned to the water, where they soon took up their natural beaver life, repairing an old dam, felling trees and building their cosy home after the fashion of their kind, for Grey Owl has no desire to domesticate them or turn them into pampered pets. Yet they continue fast friends. When his voice is heard calling at the landing place, they swim to him down the lake even if they are half a mile away. They have learned to prefer "human" food to their own diet of poplar leaves and willow shoots, and will eagerly devour the boiled rice and bannock that he brings in token of friendship.



(Top) Feeding the baby. (Centre) Grey Owl calling his beaver friends, which respond even if they are half a mile away. (Right) A beaver takes a canoe trip.

When Grey Owl has been away on journeys out on the trail they often come to meet him, far from their native element, greeting him with little wriggles and squeals of delight. Or they may be waiting at the cabin door, eager to know what edible gift he has brought them. Apples are their special delight, and as he loosens his pack they will tug at the cords in an effort to help him to open it. Then they will examine each package with almost childlike curiosity, emitting squeals of excitement when they come upon their favourite fruit. Tearing open the bag they will clutch as much as both fore paws can hold and stagger off to conceal the booty, which is eaten only one at a time.

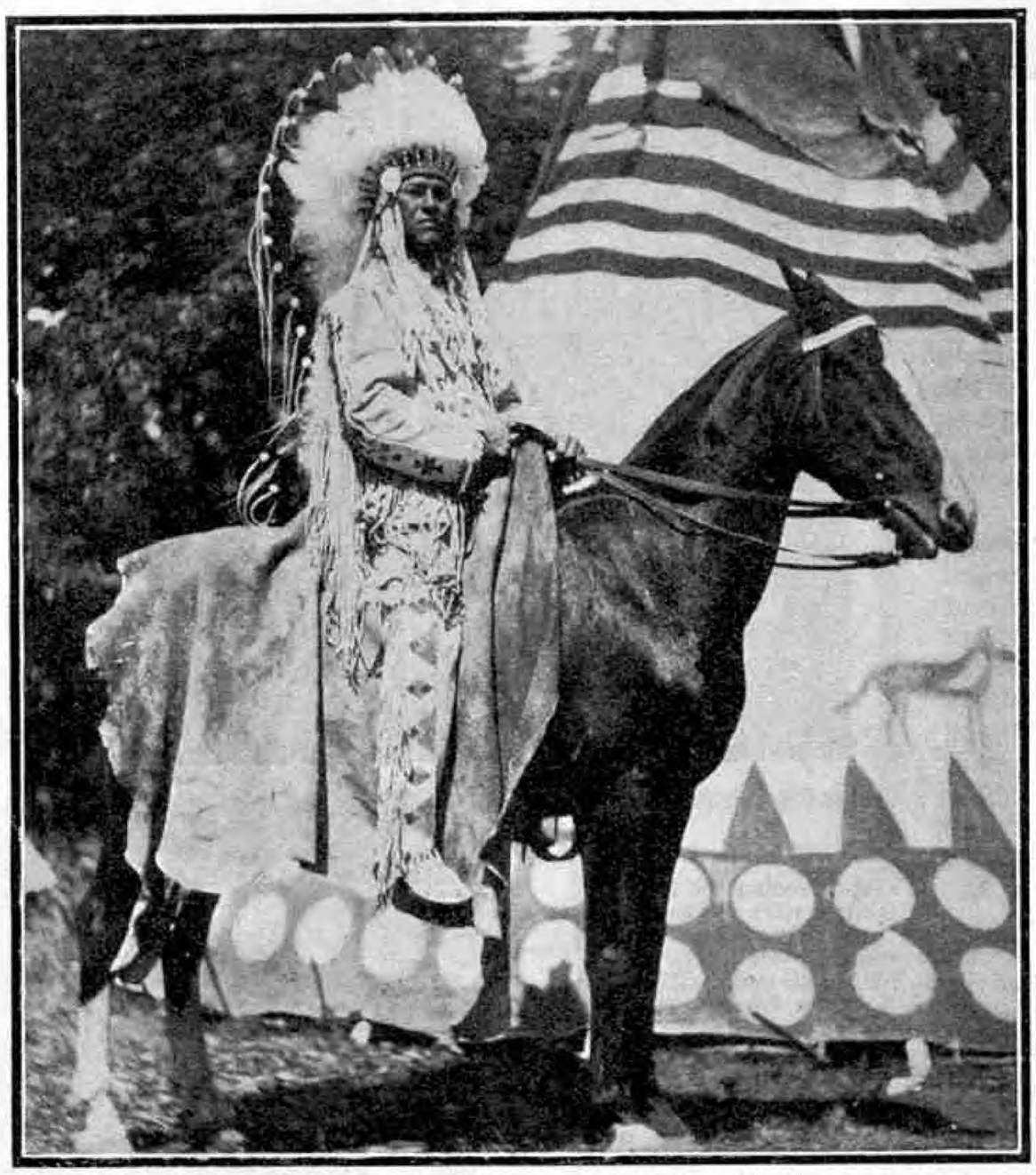
That there are unsuspected possibilities lying dormant in the natures of these little "Brethren of the Wilderness," needing only kindly interest and understanding to awaken them, this nature lover and his wife are assured. Grey Owl says:—"The voice of a beaver registers his feelings with inflections startlingly human and very easy of interpretation, from which we (*Continued on page 990*)

The Story of the Princess Pocahontas

A Red Indian Romance

IT is remarkable how the fascination of the Red Indian lingers. We may think we have grown beyond "Wild West" tales of the early days of the colonisation of North America, but whenever we come across one the old spell returns. This colonisation period is indeed one of the most romantic in history. The Indians were on friendly terms with the colonists until it became evident that the White men proposed to reserve for themselves large areas of land on which the Indians would be prevented from hunting. Friendship then changed to a hatred that resulted in a prolonged and bitter struggle between White and Red. The conflicts that occurred are vividly recalled by Mr. David Garnett's latest book *"Pocahontas," or The "Nonparell of Virginia,"** which deals with the colonisation of the part of North America now known as Virginia.

It is a strange story that Mr. Garnett has to tell, and one that links up Virginia and England as the result of a curious chain of circumstances. "I have deliberately set my imagination," says the author, "the narrow, yet impossible, task of calling my characters from their graves and making them live, act, feel and think, though not speak, as once they did." In this task one feels that he has succeeded.



A reminder of the old days of the "Wild West." An Indian chief in ceremonial dress.

Pocahontas was one of the daughters of Powhatan, the tall old king of the Virginian Indians. One day in 1607 word reached Powhatan that a large party of White men had landed their three ships in the James River and were preparing to establish themselves ashore. These colonists, who were Englishmen sent out by the newly-formed Virginia Company of London, were met by the Indians, and Parahunt, one of the king's sons, exchanged gifts with them. To all appearances friendship was established, but in the background lurked black treachery, while Powhatan and the chiefs of his tribes laid their plans for attack. One day a great yell went up from the forest surrounding the settlement, which had been named Jamestown, and 400 Indians rushed upon the unsuspecting colonists. The attack was not successful, however, as the Englishmen quickly gained the shelter of the huts, and the sudden firing of the guns aboard the three ships caused the Indians to retreat hastily.

From time to time the higher reaches of the river and the surrounding forest were investigated by the more adventurous of the colonists, and occasionally these parties failed to return. One day Captain John Smith, the leader of a party, and his two companions were attacked while exploring the forest along the banks of a tributary of the James River. His companions were killed and Smith was taken prisoner and brought before Opechancanough, a chief and brother of Powhatan. By means of a pocket compass Smith bluffed the Indian chief into believing that it was magic, and was then taken to Powhatan. This necessitated many days of marching, with rests at night at villages on the way, and at each of these Smith was fed bountifully so that, to quote the words of the author: "a suspicion grew in his mind that he was being fattened to be eaten later on. Huge collops of roast venison, dishes of dried peas, roast birds, baskets of hot new bread—more than ten men could eat, were brought to him, to dine on alone. None of the Indians would sit at meat and share the plenty with him. When he had finished the remains were swept back into the baskets, which were hung up in the room where he slept, and only when fresh food was brought for him next morning would his guards, with graceful reluctance, agree to share among themselves the viands of the day before."

Finally Powhatan's village was reached and Smith was about to be put to death, when Pocahontas, then 11 years old, begged her father to give her the prisoner so that he might make "beads and copper bells" for her. The king granted her wish, and thus Smith was spared. Subsequently he was accepted into the tribe and sent back to Jamestown. During the following months Pocahontas frequently visited Smith at Jamestown, where she made friends with the English boys of her own age.

Throughout the winter the Indian king and Smith continued on outwardly friendly terms, but each secretly distrusted the other. In all their trading

*Chatto & Windus, 8/6 net.

Powhatan tried to exchange corn and other Indian products for the swords and cutlasses possessed by the colonists. Smith was well aware of the danger of parting with these, but Powhatan's men obtained them by surreptitious stealing during their visits to the settlement. In the summer fever took heavy toll of the colonists and in the winter famine worked havoc on the health of the men. Smith contrived to keep up the stock of provisions by carrying out daring raids on Indian villages up and down the river, and he was so successful in these surprise attacks that remarkable tales of his prowess as a hunter and fighter spread among the Indian villages, and the natives began to regard him as a great chief.

In time Powhatan felt himself growing old, and the author shows how his distrust of Smith grew into fear when a discontented colonist revealed to him that Smith was planning to capture him and all his stores. One day, during a trading visit by Smith and his men, Powhatan divined that the plot was about to be carried out, and he quietly withdrew from the room. "Everything was already packed up, and while the bodyguard surrounded the house, Powhatan and his household fled across the bridges and the flat plain and did not rest until they had climbed the first hill into the forest. Smith and he were never to meet again."

New arrivals from England replenished the population of Jamestown, but brought also fresh rivalries and jealousies that ended in Smith being accused of plotting with the Indians. On the same night he was accidentally wounded, and the injury proved so serious that a report that he was dead spread among the Indians. Unknown to them, however, he recovered during a voyage back to England. In the summer of 1610 a further contingent of colonists came out from England, among them a man named John Rolfe. He was the first settler to try to grow tobacco, but for two or three years his efforts were not very successful.

Two winters after the departure of Smith the Indians of many tribes began to make their way over the snow-covered country to a great fair on the banks of the Potomac river. The party that went from Powhatan's village included Pocahontas, then 16 years old, and Rawhunt, her brother. At the fair the men traded their wares for tobacco and copper during the day, and at night joined with the women in singing, dancing and story-telling round the camp fires. In due course Rawhunt and his party returned home, but Pocahontas remained behind with an Indian named Japazaw and his wife.

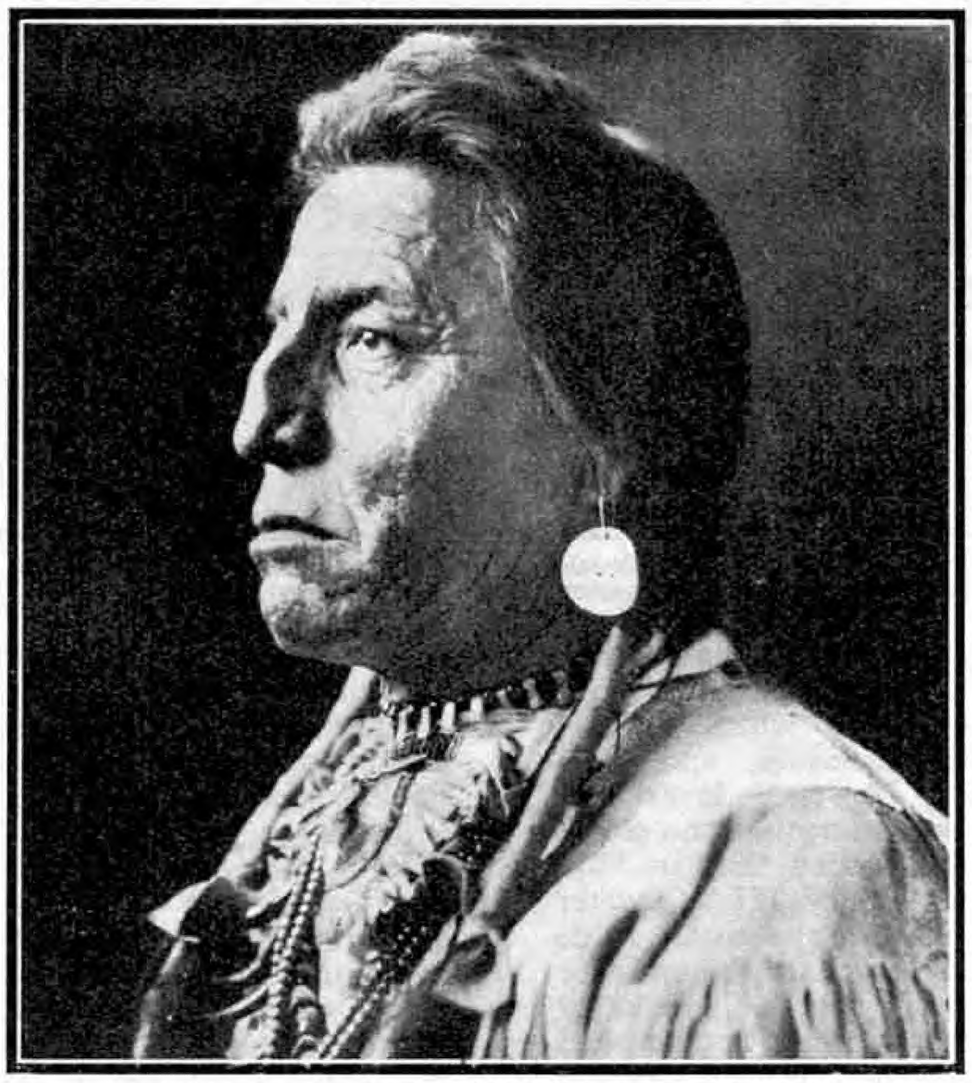


Princess "Dawn Mist" at the Indian encampment at the centenary celebration of the Baltimore and Ohio Railroad, 1927.

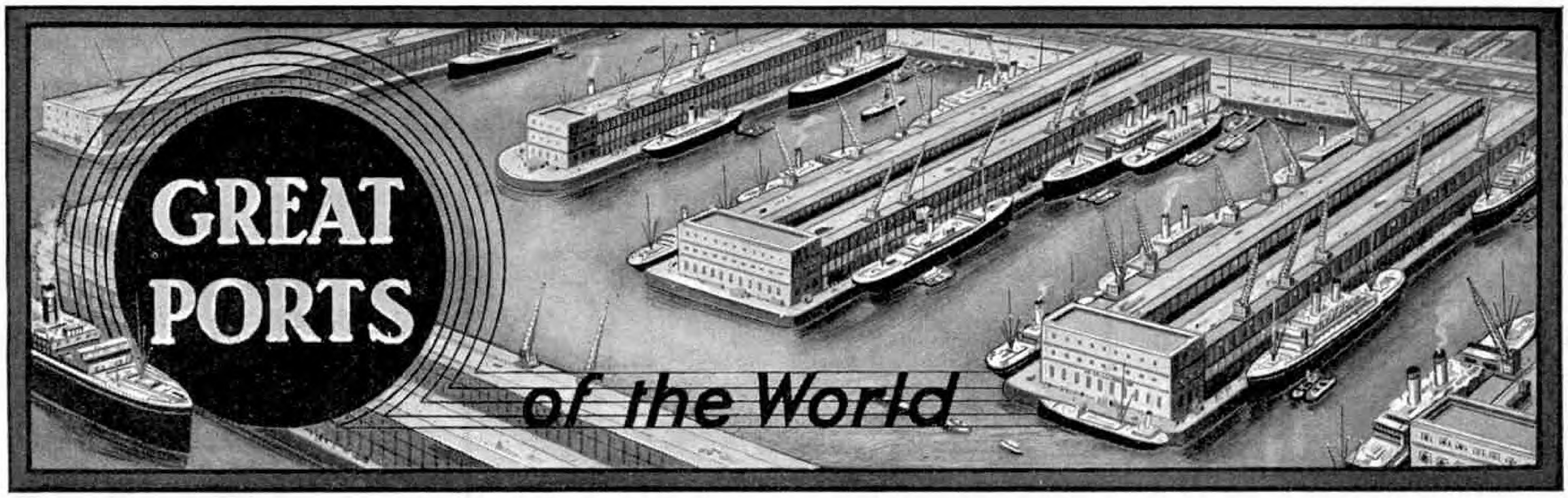
One day an English ship appeared in the river, and proved to be one of the first ships that had brought the colonists to Powhatan's kingdom. One of the men on board recognised Pocahontas as she watched the ship, and later Japazaw was persuaded to get her on board by a trick. The ruse succeeded, and Pocahontas found herself a prisoner of the English, who intended to hold her as a hostage. The ship proceeded to Jamestown, and during the many months it remained at the settlement Pocahontas was taught to read, write and speak English by the clergyman there, under whose instruction she also became a Christian. She was allowed ashore, accompanied by the clergyman, and during one of her walks about Jamestown she made friends with Rolfe, whose pioneer efforts to grow the tobacco plant greatly interested her, as at home she had been accustomed to cultivate the plant for her father. The friendship deepened, Powhatan's consent to a marriage was obtained, and this took place shortly afterwards.

Rolfe and his wife established their home a short distance outside a new settlement called Henricopolis, further up the James River than Jamestown. With the aid of friendly Indians Rolfe converted an area of the virgin forest into cultivated land, and on it he succeeded in raising good crops of tobacco. In the spring of 1616 Sir Thomas Dale, the Governor of Jamestown, returned to England, and at his invitation Rolfe and his wife accompanied him to London for a year's holiday.

During the autumn in London Pocahontas fell ill, but recovered under the care of Queen Anne's physician. Rolfe decided to return to America in March, 1617, but as the time drew near Pocahontas' health again failed, and when she was carried on board the ship she was seriously ill. She died while the ship was still in the Thames, and was buried at Gravesend on 21st March, 1617.



A study in Indian dignity: Chief "Two Gun Whitecalf."



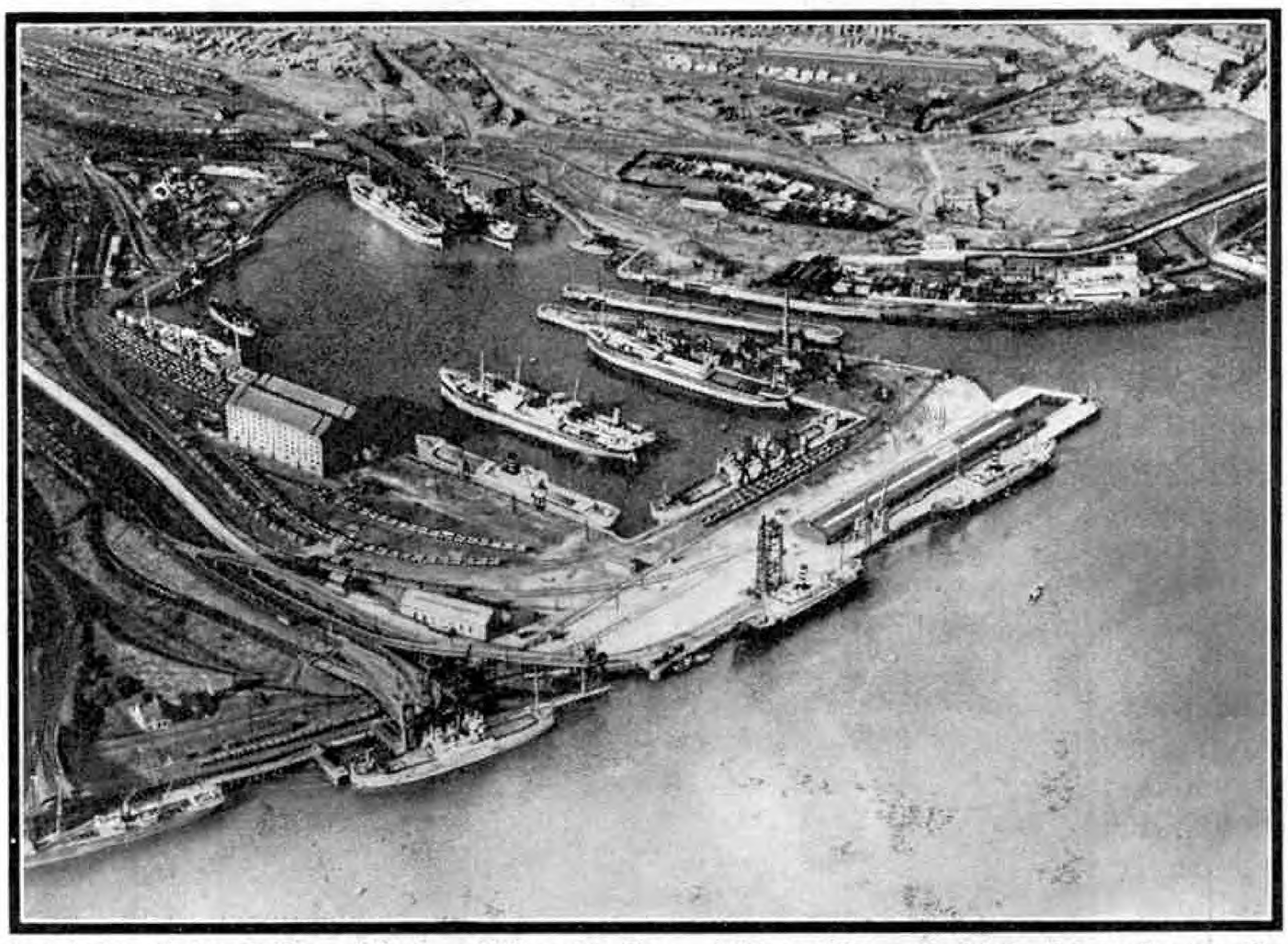
VII.—THE PORT OF NEWCASTLE-UPON-TYNE

NEWCASTLE-UPON-TYNE came into existence as one of the numerous military stations established along the great wall built by command of the Roman Emperor Hadrian in 120 A.D. to keep the Caledonians out of Britain. This 73½-mile barrier extended from Wallsend on the Tyne to Bowness on the Solway Firth, and much of it still remains. The Romans called the station Pons Aelii, and there Hadrian erected a wooden bridge across the River Tyne, which in those days was merely a shallow winding stream.

After the Romans withdrew from this country, the town became known as Monkchester. The inhabitants suffered greatly at the hands of invading Picts and Danes, and during the Norman Conquest in 1068 the town was again destroyed. In 1080 William II built a castle there, and from that time the town became known as Newcastle. Shortly afterward Robert de Mowbray fortified it, but in spite of this it was captured by William Rufus in 1095. The misfortunes of Newcastle were not over, however, and it was one of the towns attacked and captured about 1136 by David, King of Scotland. The attack was made during the king's march south to support the cause of Matilda, whose claim to succeed Henry I was being challenged by Stephen, the late king's nephew.

During the reign of Henry II the keep, which is still standing, was erected within the castle enclosure, and from that period the town made steady progress. Newcastle is situated in an area that is immensely rich in coal and comprises the oldest worked coalfield in Great Britain. It is recorded that in 1239 the burgesses of the town obtained from Henry III a charter that granted them the right to dig for coal in the castle fields in addition to pasturing cattle there. Outcrop coal in abundance was available on the extensive lands owned by the monks of Tynemouth Priory, and it is believed that they mined and shipped coal from there as long ago as 1269. History records that on one occasion in that year several Newcastle men were arrested and tried for making a raid on North Shields, and also with having seized and decamped with one of the Prior's ships, lying there laden with coal.

By the 14th century Newcastle coal was known in London and had reached France. This development of an export coal trade gave rise to the Company of Hostmen, the members of which arranged for the conveyance of the coal from the mines to the staiths at the riverside, and transported it from there in barges known as "keels" to the ships in midstream. The coal despatched to London in this way was known as "sea coal," and as it became increasingly used, at first chiefly for industrial purposes, London experienced its first smoke nuisance. Indignant citizens created a storm of protest, and in 1306 petitioned King Edward I to prohibit the use of coal in London, and this he did. The decree caused a temporary setback to the Newcastle coal trade, but as timber supplies became less abundant the price of wood soared so high that people began to be glad to avail themselves of the new fuel, and the royal order thus gradually became ignored. By the 16th century a regular export coal trade was in existence. In the reign of Charles I there was a great demand for Tyne coal in London, and the official report of the Trinity House, Newcastle, states that the coal exports in 1703, amounted to 48,000 "Newcastle Chaldrons." (2 tons 13 cwts.)

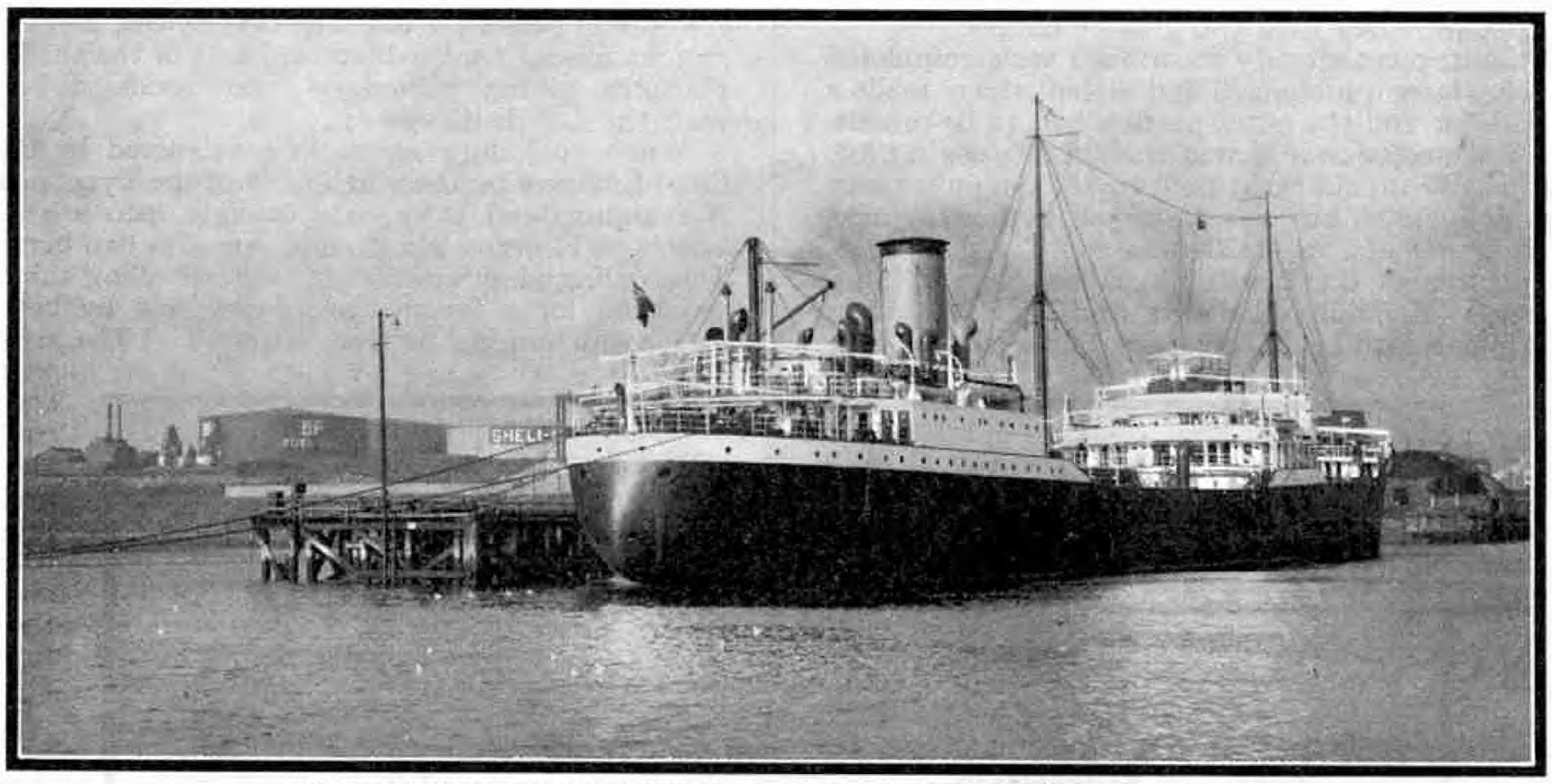


Aerial view of Albert Edward Dock and Riverside Quay. This and the upper illustration on the opposite page are reproduced by courtesy of the Tyne Improvement Commission.

An interesting development arising out of the Newcastle export trade was the completion of the Victoria Tunnel about 1840. The tunnel took three years to construct, was two miles in length, 6 ft. 3 in. in width and 7 ft. 5 in. in height. It sloped downward under the town from Spital Tongues Colliery to the Tyne and was used for the quick transporting of coal for shipment at Newcastle quay. Loaded wagons were set off at the colliery and descended under their own weight to the quay siding. When empty they were hauled back up the tunnel to the colliery by a cable worked by a steam engine at the top.

By the year 1800 Newcastle had about 15,000 inhabitants, and Gateshead, on the opposite bank of the river, and North and South Shields near the mouth of the river had populations averaging 9,000. These three smaller towns were developing steadily, and they disputed increasingly the claim of the Newcastle Corporation to be sole conservators of the Tyne. At last, after ten years of strong agitation, their claims were acknowledged by Parliament, and in 1850 the River Tyne Improvement Act was passed. Under this Act, the conservancy of the river was transferred from the Corporation of Newcastle to a new body called the Tyne Improvement Commission, that included life Commissioners (now appointed by the Minister of Transport) and representatives of the corporations of Newcastle, Gateshead, Tynemouth and South Shields. Subsequently the constitution of the Commission was enlarged by the inclusion of representatives of Jarrow and Wallsend corporations and of the payers of Tyne dues.

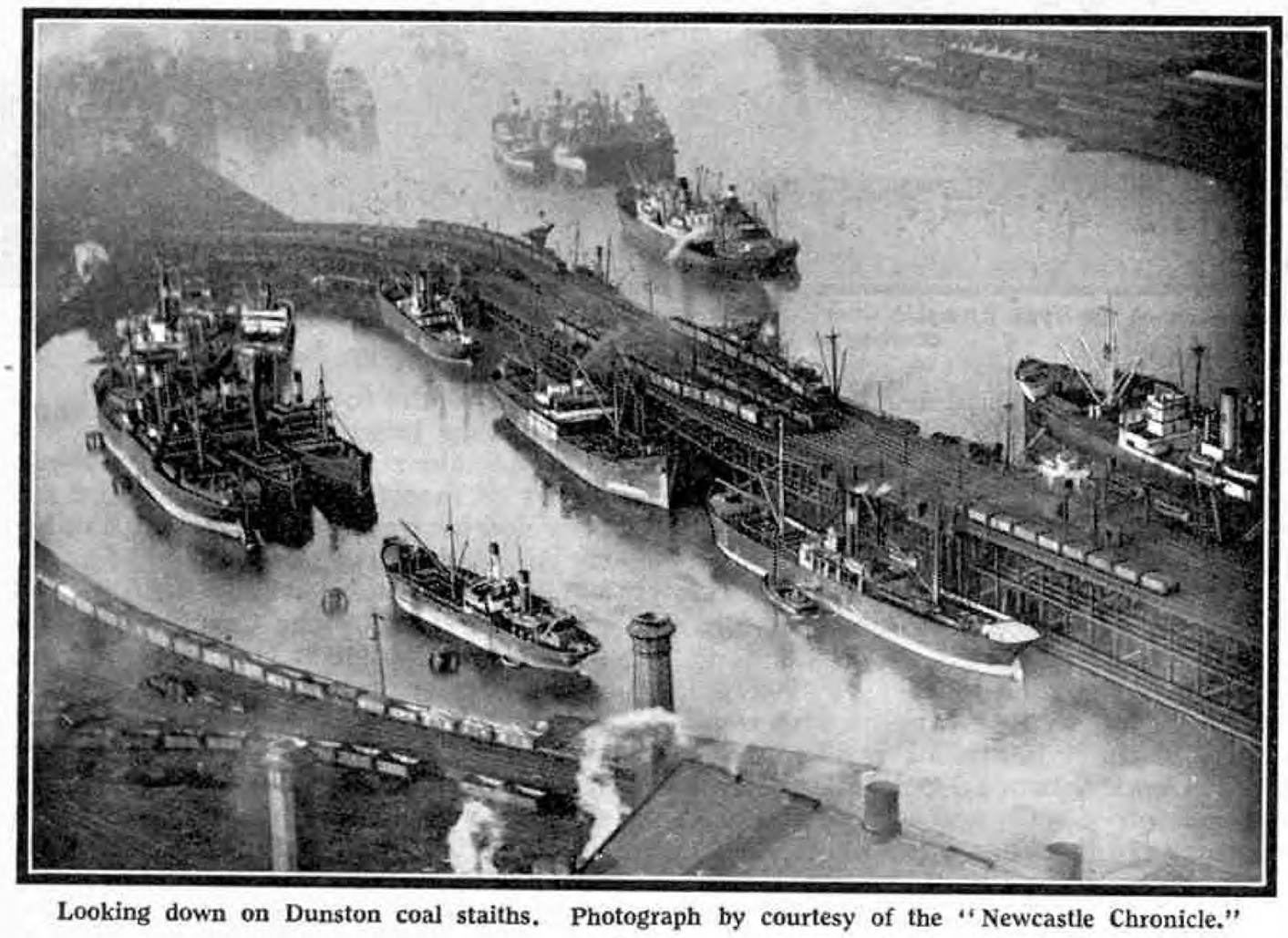
At the time the Commission was formed the river Tyne was still only a shallow winding stream, full of sand shoals that impeded the flow of its waters from the mouth up to Walker, about seven miles upstream. The unprotected river mouth was flanked on the north by the treacherous Black Middens and on the south by the Herd Sand, and across its entrance the seas fretted over a bar that left only six feet of water at low tide. At Newcastle, only about 10 miles from the sea, the Tyne was fordable at low tide, and small schooners lay aground alongside the town quay. There were no docks along the river, and large ships, then seldom exceeding 400 tons, took aboard their coal cargoes from keels in the lower reaches of the river. Smaller vessels loaded direct from quaint little wooden staiths which studded the river banks at North Shields, Wallsend and other points.



Oil tanker at the deep water river discharging and bunkering berth, Jarrow Slake.

The formation of the Tyne Improvement Commission coincided with the development of steamships, steam railways and the beginning of the present industrial age. The Commissioners at once entered upon an ambitious programme of works by which the Tyne was converted into a busy waterway deep enough to take steamers up to Newcastle Quay, and to float warships from Elswick shipyard. Whitehill Point and Bill Point, two rocky prominences which jutted out into the river between Newcastle and the sea, were cut away bodily. At Lemington, farther up the river, the channel was straightened so that the tidal flow was carried to Hedwin Streams, 19 miles up-river—the western limit of the portion of the Tyne over which the Commissioners have control.

In 1852 the Commissioners were authorised by Parliament to build two great piers at the mouth of the river. These piers jut out into the North Sea from the north and south banks of the river respectively, and are built of solid masonry at a cost of over £1,600,000. The north pier is about 2,950 ft. long and the south pier about 5,150 ft. long, and the distance between the two pier heads is approximately 1,180 ft. Thus the exposed entrance to the Tyne has been converted into a fine harbour, giving perfect protection to the large volume of shipping which resorts to the river.



Looking down on Dunston coal staiths. Photograph by courtesy of the "Newcastle Chronicle."

The Commissioners were also granted power to construct a dock on the north bank of the river, and this was opened by the Duke of Northumberland on 22nd October, 1857. It is known as the Northumberland Dock, and is 50 acres in extent, and the depth of water on the sill at high water of ordinary spring tides is 24 ft. Ships pass to and from the dock by way of an entrance lock that has an available length of 245 ft. and a width of 52 ft. There is 450 ft. of quay, equipped with four steam cranes each of 3 tons capacity, and there are three large sheds for the storage of general merchandise, and seven coal shipping staiths.

Two years later another dock was constructed, this time by the North Eastern Railway, now the London and North Eastern Railway. This structure is called the Tyne Dock, and is on the south bank and near the mouth of the river. It has an area of 50 acres, and a tidal basin covering 10 acres, and has 11,360 ft. of quay. The dock itself provides berthing accommodation for eight large ships, and the entrance basin has a quay 380 ft. long. In addition there are two river jetties 1,050 ft. and 350 ft. long respectively. The 35 electric, hydraulic and steam cranes, ranging in capacity from 30 cwt. to 5 tons, and the 30-ton electric crane, facilitate the rapid discharge of cargoes; and there are also three steam travelling cranes for loading and unloading goods in the various storage grounds on the dock premises.

The warehouses and transit sheds total 13, and the grain warehouses accommodate a total of 120,000 quarters of grain. The largest grain warehouse is a five-storey structure in which several 4-cwt. hydraulic hoists provide communication between the ground floor and the upper storeys. Railway tracks extend through the building, and therefore traffic can be loaded from the upper floors direct to railway wagons, and vice versa. Three warehouses are set aside for general goods and eight for timber and wood pulp. Four staiths in the dock for the shipment of coal enable 16 ships to be loaded simultaneously, and it is interesting to note that the Tyne Dock has shipped more coal than any other dock in the world, the total exceeding 313,000,000 tons.

In 1874 the Commissioners' Nos. 1 and 2 River Staiths atWhitehill Point were opened for traffic. These staiths are near the Northumberland Dock.

The third wet dock on the Tyne was built by the Tyne Improvement Commission and was opened for traffic in 1884. It is known as the Albert Edward Dock, and is nearer the harbour entrance than any other dock on the river. The dock covers an area of 22¼ acres, and can accommodate ships of 25 ft. draught and 400 to 450 ft. long. The equipment consists of one steam travelling and 22 hydraulic and electric cranes, ranging from 30 cwt. to 23 tons lifting capacity, and a large warehouse suitable for the storage of grain and all kinds of general merchandise. There is also a coal shipping staith at which two ships can be accommodated. The quays inside the dock have a total length of about 3,000 ft.

Two additional river staiths, known as Nos. 3 and 4, were

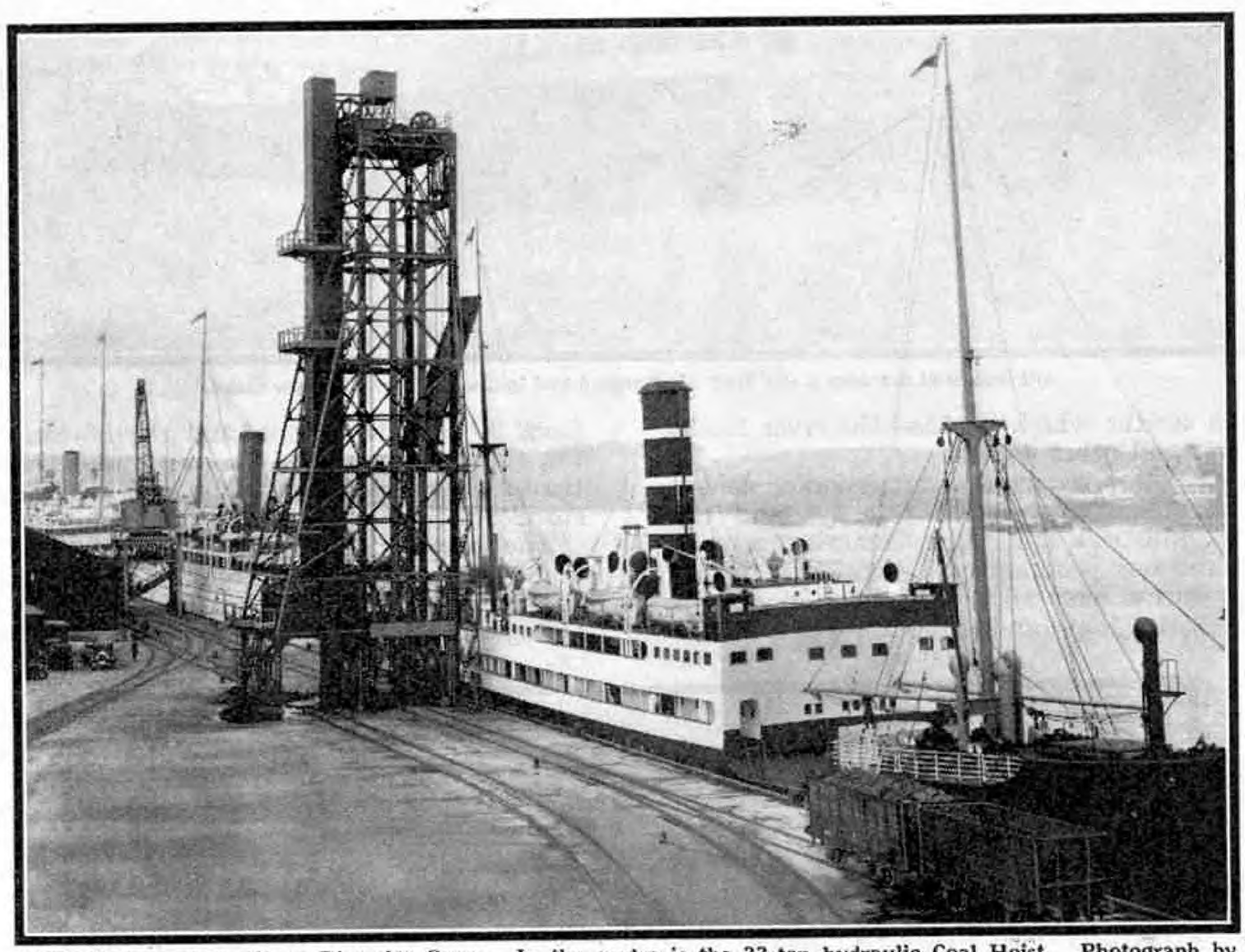
completed at Whitehill Point in 1891, and two years later the Dunston Staiths of the North Eastern Railway were opened for traffic. The Dunston Staiths were built to meet the increasing output of export coal from collieries west of Newcastle, and to save the longer rail journey to the docks near the mouth of the river. They are situated on the south bank of the Tyne, just west of Newcastle, and consist of a high-level jetty that extends into the river, and provides six berths at which loading can be carried on at any state of the tide. There are three electric conveyors, and each berth is also provided with two gravity chutes.

The North and South piers already mentioned were completed in 1895, but two years later a prolonged and violent storm made a breach in the North Pier and the outer portion had to be rebuilt.

An extension to the Dunston Staiths was brought into use in 1903.

A fifth river staith at Whitehill Point built by the Commissioners was opened for traffic in 1904, but was destroyed by fire the next year. The reconstruction of this staith was completed in 1908, and of the outer portion of the North Pier about a year later.

At the Commissioners' Whitehill Point Staith in the river large vessels requiring to load coal (cargo and bunkers) and coke without entering the docks can take in full cargoes and proceed direct to sea at almost any state of the tide. Numbers 1, 2 and 5 staiths are fitted with hydraulic hoists capable of lifting high-capacity wagons containing 23 tons of coal to an approximate height of 45 ft. above the staith level, which enables very large steamers when light to be coaled at the highest spring tides. At each of the five staiths endless coal band conveyors are fitted for loading and bunkering steamers of exceptional height. No. 5 staith is provided with an anti-coal breakage appliance, and a similar appliance is at present in course of construction at No. 4 staith. The depth of water at low water of ordinary spring tides at the Whitehill Point coal berths is 24 ft. at Nos. 3 and 4, and 30 ft. at Nos. 1, 2 and 5. The maximum height of shipment is 85 ft. above low water of ordinary spring tides at No. 5 staith.



Typical scene at the Tyne Riverside Quay. In the centre is the 33-ton hydraulic Coal Hoist. Photograph by courtesy of the Tyne Improvement Commission.

The intervention of the Great War brought further Tyne developments to a standstill, and it was not until 1922 that any new works were carried out. In that year the fuel oil berth at Jarrow Slake was completed, and in 1923 the West Dunston Staiths, a high-level jetty with three loading berths, of the London and North Eastern Railway were opened for traffic.

Another important post-war addition to the shipping facilities of the port was the construction of the 1,100 ft. Riverside Quay along the riverward side of the Albert Edward Dock. This side of the dock consisted of a concrete quay wall, and the maximum depth obtainable alongside was about 14 ft. at low water of ordinary spring tides. The first stage in the construction of the new quay was to drive steel sheet piling along almost the whole length of the wall. The piling was tied back at frequent intervals to anchor blocks placed under the passenger platform of the transit shed. Dredging was carried out along the whole length of the quay, to a depth of 25 ft. at low water of ordinary spring tides.

The river bed on which the quay is built is of a varied nature, consisting of sandstone at the south end and of soft mud at the north end. This variation of strata made necessary different methods of construction, and three different systems were adopted. The south end of the quay was built on cylinders, from 6 ft. to 13 ft. in diameter, which were sunk under compressed air until they rested upon rock and were then filled with concrete. Northward of these cylinders the quay was carried on ferro-concrete piles, and still further northward, where soft material extends to a depth of about 80 ft. below low water of ordinary spring tides, steel piles up to 90 ft. long were driven down to rock and encased in steel tubes, which were then filled with concrete. The superstructure of the quay is of ferro-concrete, except at the north-east end where timber has been used for fendering purposes.

The Riverside Quay is equipped with four electric cranes of from 1½ tons to 5 tons lifting capacity, and a 33-ton hydraulic coal hoist capable of delivering into ships 500 tons of coal per hour. There is a single storey transit shed 620 ft. long by 60 ft. wide, containing passenger and Customs offices, and accommodation for merchandise. On the landward side of the shed there is a railway platform giving passengers and goods direct communication with the L.N.E.R. system.

A new coal shipping staith constructed by the Commissioners' Chief Engineer on the north bank of the Tyne, near the west end of Northumberland Dock, was brought into use a year ago. It is known as Howdon Staith, and provides two berths for large ships. The coaling plant consists of two travelling shipping towers, with provision for a future third tower, fed by belt conveyors from wagon discharging hoppers situated at the riverside end of the wagon sidings. The wagons travel by gravity to and from the discharging point, and the sidings accommodate 3,680 tons of coal in 20-ton wagons, and there is room for future extension to about 5,440 tons.

The coal is carried from the wagon discharging hoppers to the vessels being loaded, on rubber and canvas belt conveyors 3 ft. 6 in. wide, and two of these conveyors are 630 ft. long from the hopper to the pivot of the west shipping plant. Each shipper with its associated conveyors can load 500 tons of coal per hour at a belt speed of 350 ft. per min. The whole plant is electrically operated, and each shipping point is under the control of the driver situated in his cabin high up on the riverside of the tower, from which he can look down into the hold of the ship being loaded. The present dredged depth of water alongside the staith is 25 ft. at low water of ordinary spring tides. A tier of moorings 400 ft. long and mooring dolphins have been provided for waiting ships, which can be put into position alongside the staith at any state of the tide.

The quays at Newcastle have a total length of about 5,955 ft. and are owned by the Corporation, who also own two new short quays totalling 848 ft. and situated about one mile down the river from the town quay. There are 17 storage sheds on the town quay, with a combined floor area of about 225,000 sq. ft., and a spacious shed at the two new berths. The town quay is equipped with five steam travelling cranes, five electric travelling cranes and a fixed electric crane capable of lifting up to 65 tons. Railways and sidings extend the full length of the quay, connected to the London and North Eastern Railway Company's quayside goods yard from which goods are conveyed to the main line at New Bridge Street. A further extension of the quay eastwards, 693 ft. long, is nearing completion, making the total length 6,648 ft. This quay has a width of 200 ft., and is being dredged to a depth of 30 ft. below low water of ordinary spring tides. One 30-ton and one 5-ton electric travelling crane will be provided at the quay.

The industrial greatness of the port has been built up on coal and, as mentioned earlier, the export coal trade of the port dates back to the middle of the 13th century. The huge growth of this traffic is shown by the fact that in a year 21,553,964 tons of coal have been shipped from the Tyne. Newcastle has the enormous advantage of having the Northumberland steam coalfield on the one hand and the Durham bituminous coalfield on the other. Northumberland steam coal is shipped to all parts of (*Continued at foot of next page*)

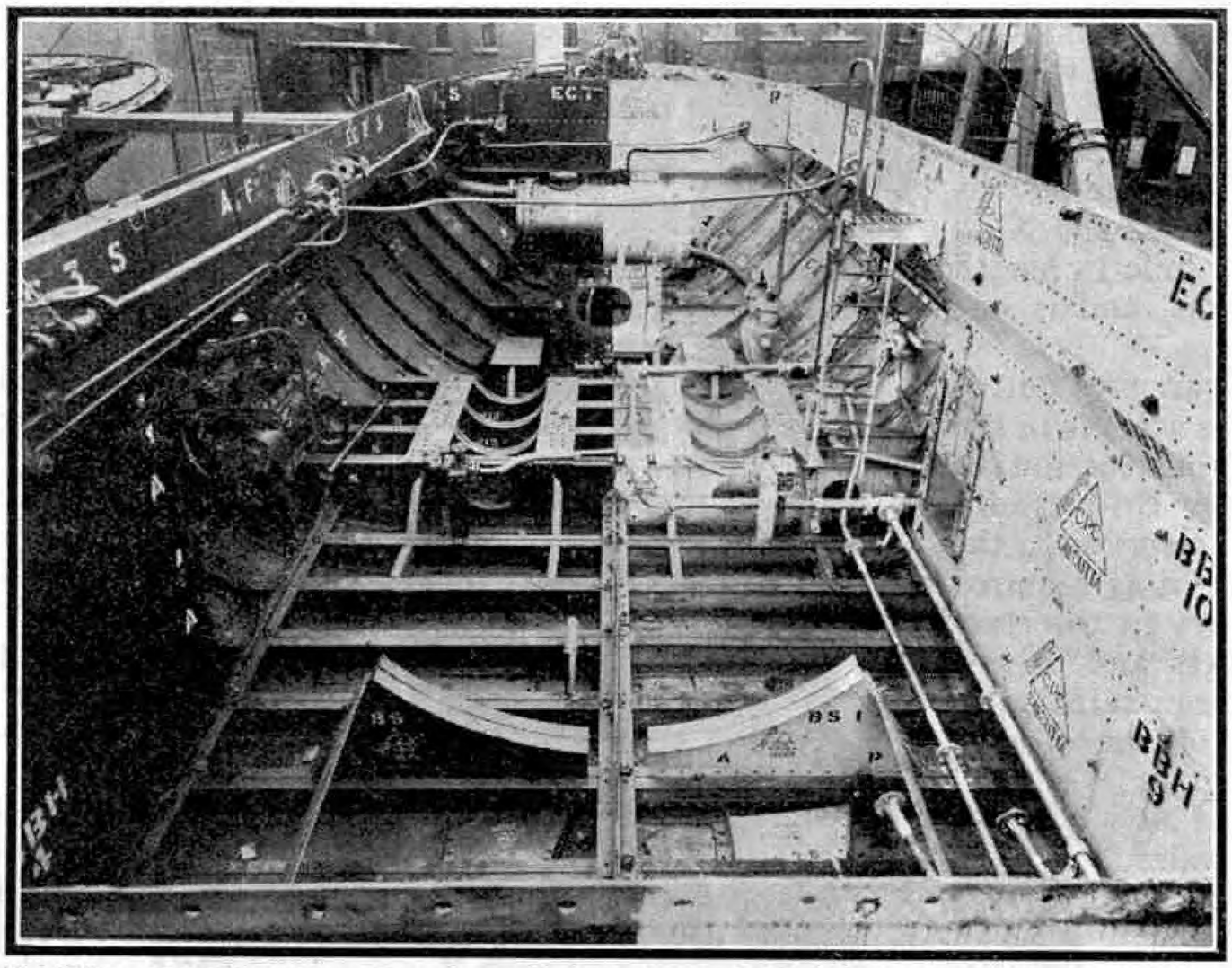
Ships Built like Jig-Saw Puzzles

Transport Abroad in Pieces

By "Supervisor"

MANY interesting vessels that are built in British yards are never launched in the normal manner, because the contracts for their construction stipulate that they are to be shipped in pieces to their overseas destinations to be re-erected on arrival in readiness for service. This is particularly the case for small vessels generally of light draught that are intended for use on rivers and in harbours and other narrow waters. Such small vessels as these cannot safely cross thousands of miles of ocean under their own power, and therefore they make their voyages overseas in the holds of cargo steamers. Larger vessels required for service on inland sheets of water also must be shipped in this manner. Many passenger and cargo boats now plying on great lakes, such as the Victoria Nyanza and other inland seas of Africa, were temporarily erected in the shipyards where they were built, then taken to pieces for transport by boat and train, and finally erected on the shores of the lakes on which they were to be launched and used.

Work on a vessel that is to be transported overseas in sections proceeds in the usual manner until the riveting stage is reached. Then bolts are used instead of rivets, and as these are required merely to hold the vessel together while on the stocks, comparatively few are employed, most of the rivet holes punched in the plates and angles being left unfilled. Only tanks, ventilators and a certain number of other parts that are not too bulky or too heavy are completed by riveting.



The boiler and engine room sections of a small cargo steamer that is to be transported overseas in pieces. The port and starboard sides of the vessel are painted in different colours and every portion is carefully numbered to facilitate the work of re-erection.

The vessel and its machinery are painted in two colours in order to assist in re-erection. A centre line is marked on the structure, inside and outside, and every section on the port side of this line usually is painted red, the corresponding portion on the starboard side being painted green. It will be noticed that these colours are those of the navigating lights used on the corresponding sides of the vessel. If a shipbuilder has been fortunate enough to obtain an order for an additional vessel for the same owners, and the two have to be dismantled and shipped abroad together, a different pair of colours must be chosen for the second one in order to avoid confusion.

It is a novel and interesting experience to inspect one of these ships immediately before it is dismantled in readiness for sending overseas. The two-colour painting scheme gives the structure an unusually gay appearance, and it is not dark in the holds and shaft tunnels, as is usually the case, because light finds its way through the thousands of unfilled rivet holes. Stencilled letters and figures abound, even on the smallest pieces, and these are identification marks put on by the shipbuilders. They are very necessary for the guidance of those responsible for reconstruction, for in their absence the fitting together of the innumerable pieces of steel of all sizes and shapes into which a "knock down" ship is divided would keep a jig-saw puzzle expert busy for a lifetime! Key plans showing the colours and identification marks of every part are prepared with great care and sent out with the components, with the result that little trouble is experienced in sorting out the pieces and assembling them.

Some of the vessels shipped in pieces go to ports where cranes and other facilities for re-construction are available, and in many cases the work is carried on in proper building and launching berths, but at times the pieces have to be transported by mules, or even on the backs of native carriers to parts many miles inland and over difficult country, and only rough tools and crude lifting gear are available for the task of assembling them. In cases of this kind the parts must be small, and even the boilers must be designed to be built up from small plates of light weight. Difficult problems often arise in the erection and launching of such vessels, and these can only be tackled successfully by supervisors of stout hearts and considerable initiative, and who are expierenced in handling the native labour employed.

Great Ports of the World—(*Cont. from p. 936*)

the world because of its quality and relative cheapness; the Durham gas coal is mainly the material from which London and many of the large English cities produce their gas, and it is also used by many gas companies on the Continent and elsewhere. The port is also the main outlet for the large quantities of Durham patent oven and foundry coke which are sent overseas and to home ports; and last year 855,950 tons of coke were exported from Newcastle. The largest quantity of coke ever shipped from the Tyne in a year was 1,385,651 tons.

The abundant supply of bituminous coal has given rise to an extensive trade in coal by-products, and considerable quantities of tar, pitch, resin, tar oils and sulphate of ammonia are exported from Newcastle. Chemicals, lead goods, iron and steel manufactures, and textile goods are among the other commodities classed as general merchandise. On the import side, large quantities of timber and wood pulp, grain and provisions, fish, fruit and vegetables and petroleum spirit are brought into the port. The total quantity of merchandise imported and exported in one year has approached 3,000,000 tons.

The Tyne Improvement Commission are responsible for maintaining an adequate river channel for shipping. The channel of the Tyne from the sea to opposite Northumberland Dock entrance, a distance of about 3¼ miles, is now dredged from time to time to a depth of about 30 ft. at low water of ordinary spring tides; and from this dock entrance to Derwenthaugh, a distance westward from the sea of 14¼ miles, to a depth of about 25 ft. at low water of ordinary spring tides. Up to the end of last year the huge total of 158,990,328 tons of material had been dealt with.

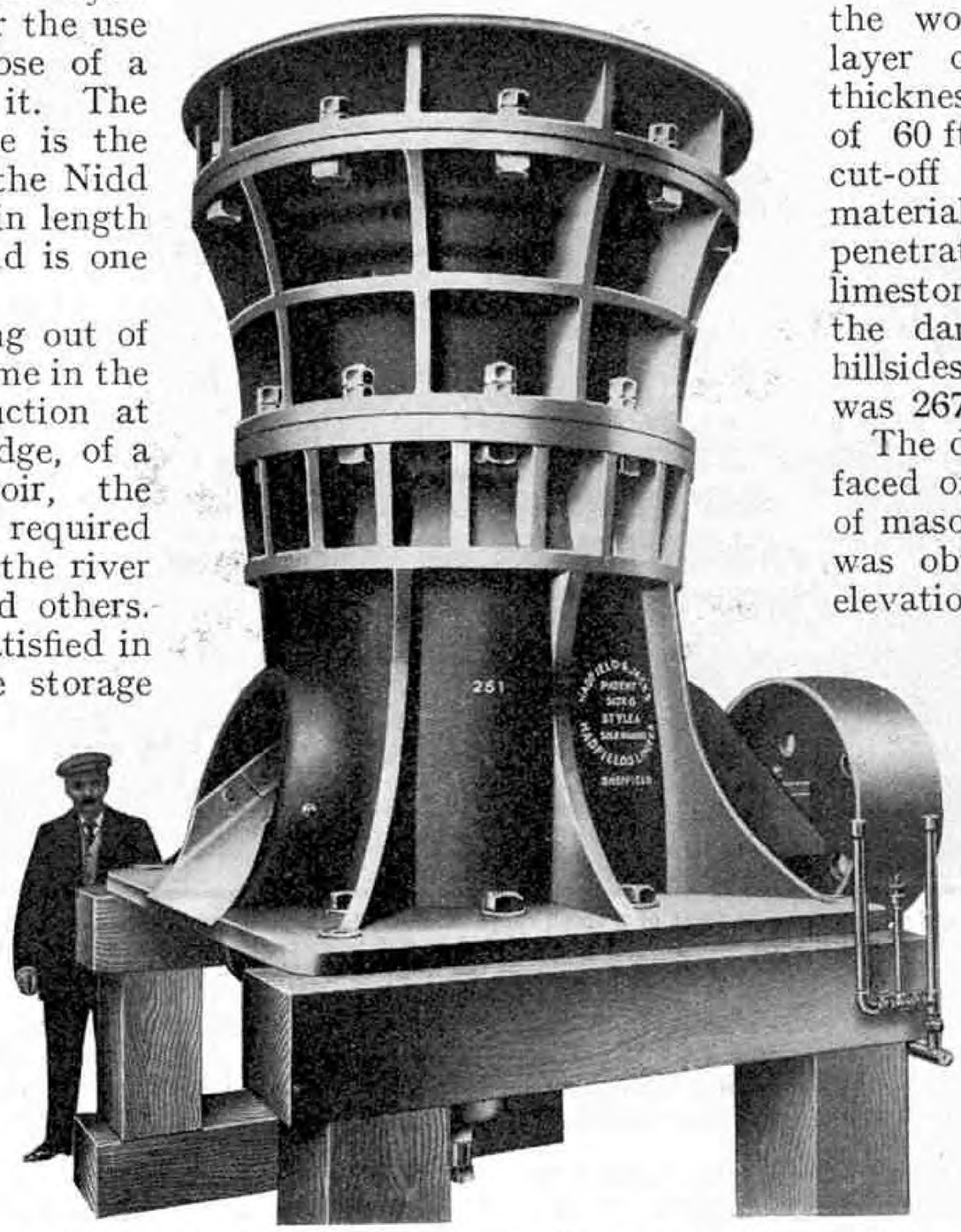
We are indebted to the Tyne Improvement Commission for much of the information contained in this article.

Building a Giant Yorkshire Dam

Cranes and Stone-Crushing Machines at Work

FOR many years the upper valley of the Nidd, on the Yorkshire moors above Pateley Bridge, has been the scene of gigantic engineering works that are being carried out in order to provide the city of Bradford with an ample water supply. When they are finished, the water storage available for the city will be increased by nearly 5,000 million gallons, and no less than 22 million gallons a day will be conveyed to it from this source alone for the use of its inhabitants and of those of a number of townships adjoining it. The central feature of the scheme is the construction of a dam across the Nidd that is over a third of a mile in length and 168 ft. 6 in. in height, and is one of the largest in Europe.

The first step in the carrying out of the Bradford Waterworks scheme in the Nidd Valley was the construction at Gowthwaite, near Pateley Bridge, of a special compensation reservoir, the water from which is drawn as required to maintain a regular flow in the river for the use of mill-owners and others. Local interests having been satisfied in this manner, the first of the storage reservoirs for the city's supplies was constructed at Angram, about 10 miles higher up the valley, and at the same time an aqueduct was constructed between Angram and the city. This aqueduct is 32 miles in length and ends in Chellow Heights, an elevated site near Bradford, where the water supply from the Nidderdale sources is carefully filtered and purified before it is allowed to enter the extensive distribution mains.



A gigantic crushing machine that breaks into 6 in. cubes pieces of stone weighing up to a ton. Photograph by courtesy of Hadfield's Ltd., Sheffield.

On the completion of these works the construction of the second storage reservoir was undertaken. The point chosen was at Scar House, about 10 miles above Pateley Bridge, and nearly two miles below Angram. There the Nidd flows between two steep ridges, and it was decided to erect a gigantic dam across the valley and at right angles to the course of the stream. This dam is nearing completion and is a gigantic wall of stone and concrete 1,825 ft. in length, and weighing about 900,000 tons. It is 135 ft. in thickness at its base, and the outer face slopes inward to give the wall a width at the top of only 14 ft. The inner face also slopes inward, but only very slightly. In the middle of the dam there is a spillway through which surplus water will flow away when the reservoir is full. This is 300 ft. in width and the overflow sills are 154 ft. 6 in. above the bed of the river. The top of the wall itself is 14 ft. above the sills, and the parapets are 5 ft. higher, the roadway built along the top of the Dam being carried across the spillway on 10 arches.

An immense amount of excavation was necessary in preparation for the work of construction. About 460,000 cu. yds. of limestone and shale were removed from the site of the dam in the first $3\frac{1}{2}$ years' work in order to prepare the foundations, the work being continued until a layer of hard limestone of great thickness was reached at a depth of 60 ft. below the river bed. A cut-off trench, to be filled with material through which water cannot penetrate, was carried down to this limestone over the entire length of the dam, and at its ends on the hillsides its depth below ground level was 267 ft.

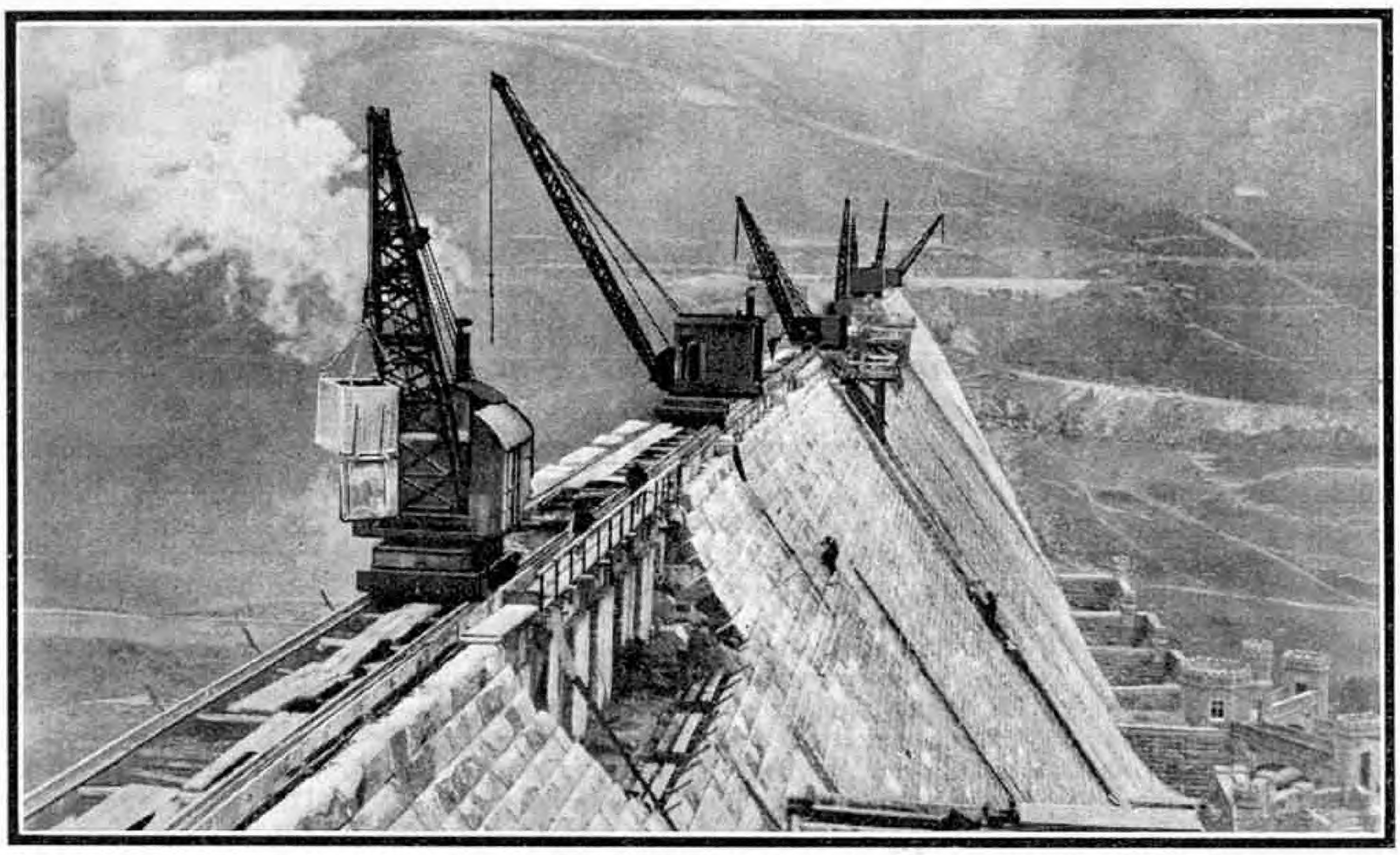
The dam is constructed of concrete, faced on each side with great blocks of masonry. Stone for both purposes was obtained from a quarry at an elevation of 400 ft. above the high water level, and was carried to the stone dressing yard, and to the crushing and concrete-mixing plants, in side-tipping wagons running on an inclined railway.

The concrete was placed in the dam by means of box skips with hinged bottoms. These were conveyed from the mixing plant on flat cars drawn by locomotives on a track of standard gauge, and were then lifted by locomotive cranes in order that the concrete could be placed where required. The cranes were employed also to lift the large blocks of stone required for facing the dam. Work has proceeded steadily year by year, about 35 ft. being added to the height of the dam annually. The total quantity of concrete and masonry in the finished structure will be about 540,000 cu. yds., and it is expected that the whole of the work will be completed in the autumn of next year.

The building of such a gigantic dam would be almost impossible without efficient machinery, and that employed at Scar House is of the greatest interest. During the busiest periods of construction, 12 locomotives, 20 steam locomotive cranes and three steam shovels were constantly in use, in addition to stone crushers and concrete mixers. The crushers and mixers, and also many conveyors, compressors and cableways that were continually in operation, were driven electrically, and part of the power required was supplied by

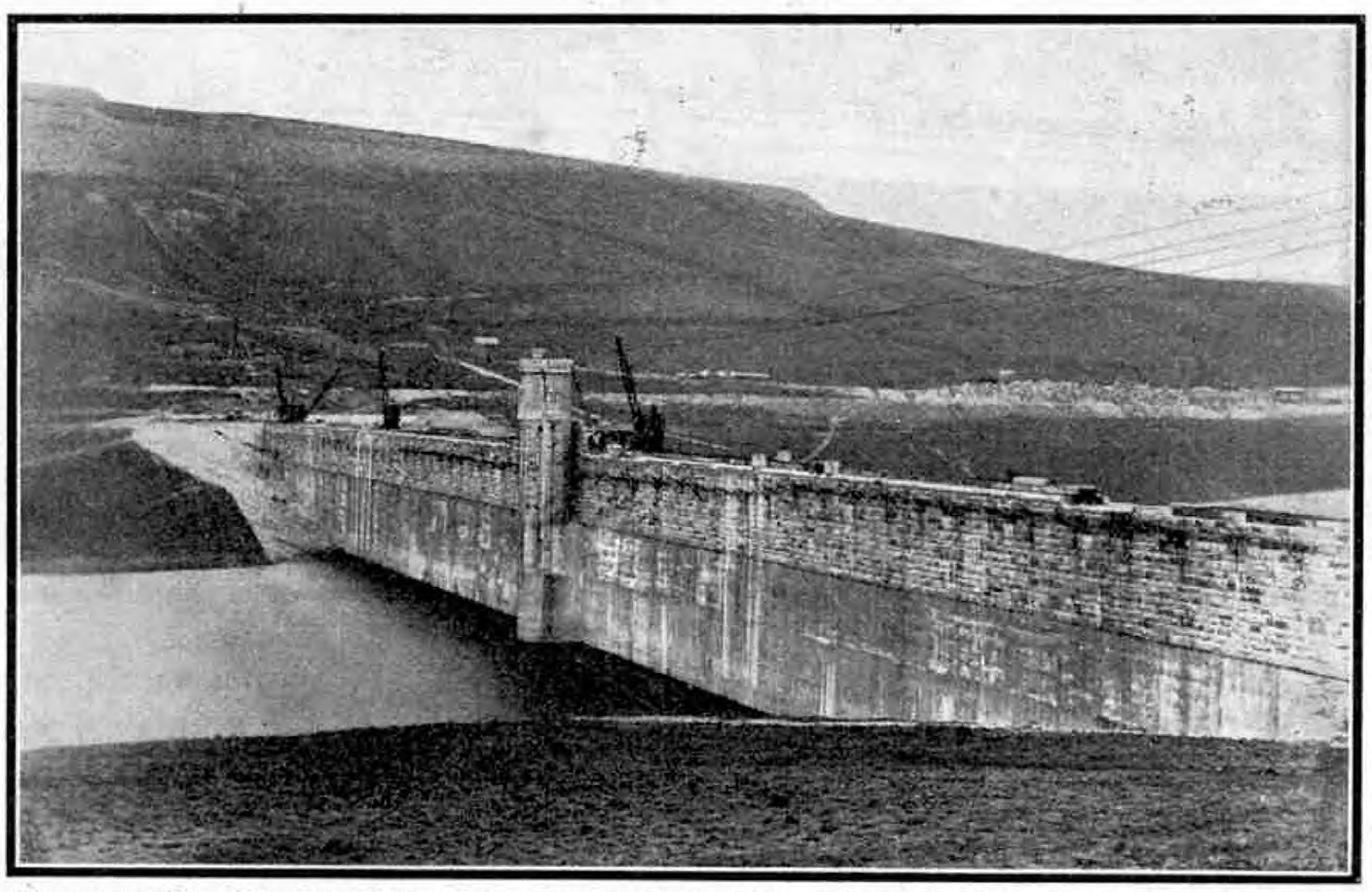
means of a hydro-electric station placed on the pipeline conveying water from Angram to Bradford. This station was capable of developing 500 h.p. throughout each working day of eight hours, and further power was derived from a steam-generating plant of equal capacity.

The stone required for the concrete was broken up by means of a large Hadfield crusher capable of dealing with 120 tons per hour. This machine was made of steel throughout, its frame being a single piece of cast steel weighing 20 tons; and it was driven at 180 r.p.m. by means of a 120 h.p. electric motor. The feed opening was 42 in. in length and 30 in. in width, and the huge pieces of stone fed into it, some of which themselves weighed about a ton, were crushed between its great jaws of manganese steel into cubes of from six to eight inches.



Locomotive cranes at work pouring concrete and setting masonry during the erection of the Scar House Dam across the valley of the Nidd. Photograph by courtesy of Thos. Smith & Sons (Rodley) Ltd.

The cubes of stone from the large crusher were delivered into the steel trays of a long conveyor that carried them to smaller machines in which they were further reduced in size. Two of these secondary stone breakers were employed. They were of the type known as gyratory crushers, the stones being broken up by the oscillating motion of the crushing cones within the concave shells, both of which were of manganese steel. The machines were driven by motors of 60 h.p. each and each was capable of crushing 60 tons per hour, the pieces emerging from them being about 2 in. in diameter. The shoot from the conveyor to these crushers could be removed when required in order that they could be fed with smaller pieces of stone brought direct from the quarries on a separate feed track.

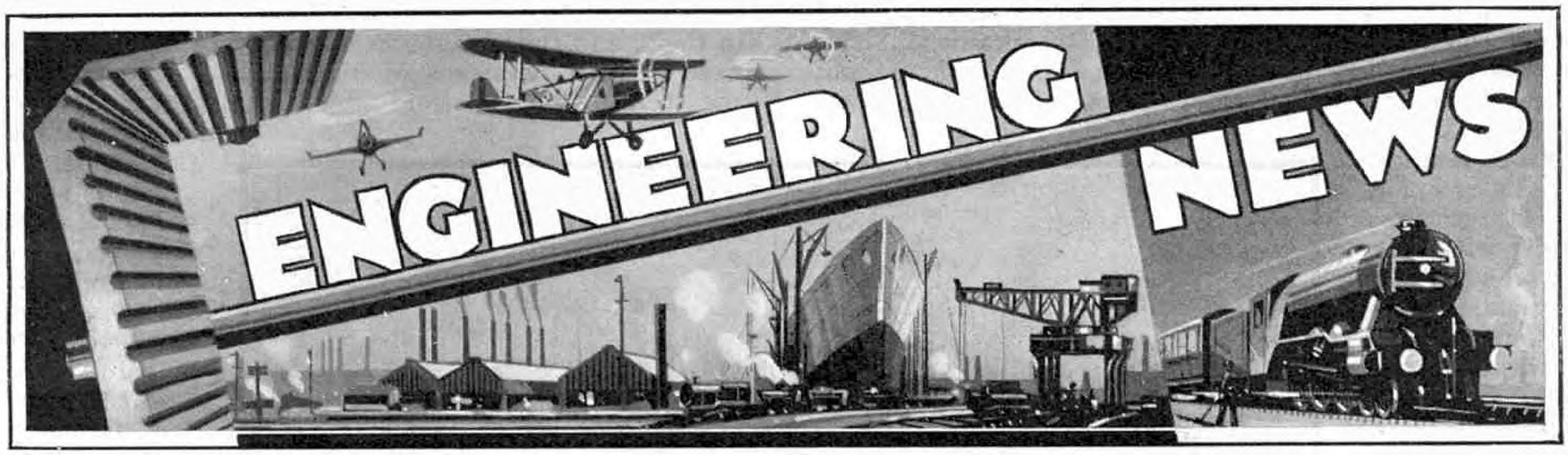


The upper side of the Scar House Dam, showing the position of the artificial lake to be formed behind it. Photograph by courtesy of W. Newlands, M.Inst.C.E., Waterworks Engineer, Bradford.

When the stone had been sufficiently reduced in size it was passed through a shoot into screening cylinders 12 ft. in length and 4 ft. in diameter. Stones less than half-an-inch across fell through the openings in them, and the two grades of material thus separated were carried by means of inclined belt conveyors to the storage hoppers, from which supplies were drawn as required for the mixers.

The locomotive cranes employed in the work of construction included 10 built by Thos. Smith and Sons (Rodley) Ltd. These were first employed in the work of excavating the site, and afterwards in lifting the necessary building material for the construction of the dam. Two of them were electrically driven, the remaining machines being steam cranes, and all were designed to lift loads of seven tons at a radius of 15 ft. Their jibs were 50 ft. in length and were capable of dealing with five tons at a radius of 20 ft. while a weight of $2\frac{1}{2}$ tons could be raised at the maximum extension of 40 ft.

The total weight of each crane was about 40 tons. The carriage frames were built of rolled steel and corrugated steel three-quarter housings were fitted. Cast steel was employed in the construction of the gearing. The axles were fitted with two sets of steel-tyred travelling wheels in order to enable the cranes to be used on rails of gauges 4 ft. $8\frac{1}{2}$ in. and 7 ft. as required. Hoisting, lowering, jib-derricking, revolving and travelling motions were provided and the cranes were capable of a speed of 300 ft. per minute. They hoisted their maximum load of 7 tons at a rate of 70 ft. per minute. Double purchase spur gearing was employed in the hoisting motions, which were fitted with two foot brakes, and the ropes were non-twisting and were 260 ft. in length. The boilers of the steam cranes were 8 ft. 6 in. in height, and 4 ft. in diameter, the working pressure being 100 lb. per sq. in. The cylinders were 8 in. in diameter and had a stroke of 12 in.

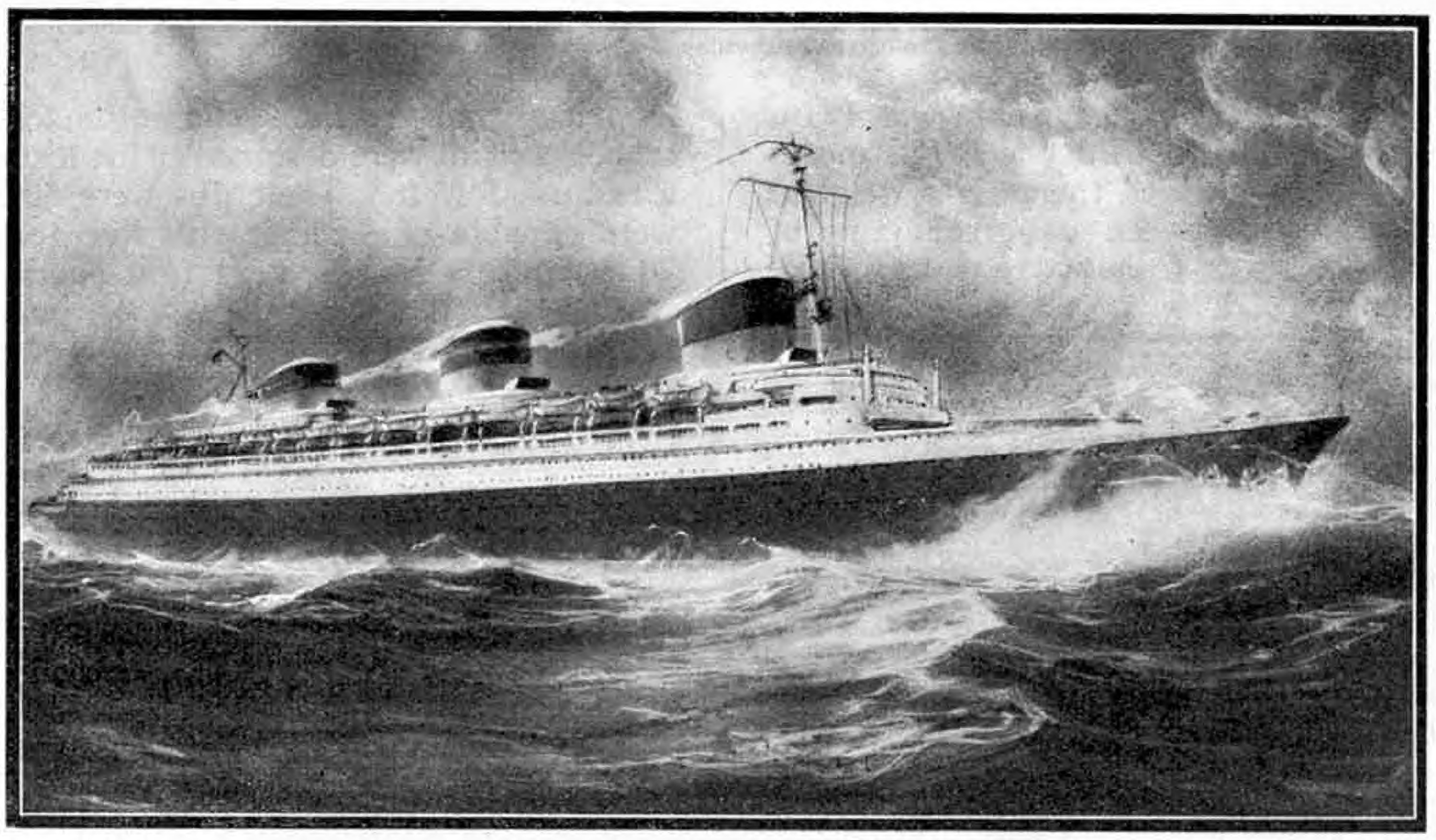


World's Largest Level Luffing Crane

The largest level luffing crane in the world has been built by Babcock and Wilcox Ltd., for service at Durban. The crane is electrically operated and is capable of dealing with loads of 80 tons. An interesting feature of the installation is that the crane is carried on a track consisting of four lines of rails, 80 ft. in length, laid at right angles to the face of the quay wall. Thus when the crane is not in use it can be moved back out of the way, and as the rails are sunk below the surface of the ground, the ordinary railway track for wagons, which is parallel to the quay wall, can be brought back into service merely by fitting small removable pieces of rail into the channels left by the crane's track.

The crane is of huge size, the height from the level of the wharf to the hook when it is in its highest position being 78 ft. The hoisting machinery is capable of lifting its maximum load of 80 tons at a rate of 5 ft. 9 in. per minute. Loads of this amount can be luffed out to a radius of 62 ft. 6 in., but a special prevention device makes it impossible for this radius to be exceeded when the maximum load is being carried, and another device ensures that loads above 80 tons are not lifted. When the crane is luffing with its maximum load it can operate at a speed of 60 ft. per minute from minimum to maximum radius, the luffing machinery consisting of an electric motor developing 30 b.h.p. at 750 r.p.m. A 35 b.h.p. motor operated at 650 r.p.m. drives the slewing gear, while a similar motor is employed for travelling purposes. The speed of the crane is 30 ft. per min.

The power for the crane is supplied at a pressure of 550 volts, and is brought to the crane by a special flexible trailing cable 60 ft. in length, provided with a plug that can be fitted into either of two special plug boxes installed near the track.



An artist's impression of the "Normandie," the biggest ship in the world. This French vessel has a displacement of 75,000 tons and is expected to be able to cross the Atlantic in 4 days 11 hours.

Machine for Smashing Pavements

An interesting machine for breaking pavements and other solid structures has been developed by the Keystone Trailer Company, of Beaver Falls, Pennsylvania, in the United States. The machine is adapted from a bucket excavator, and it can be converted to its unusual purpose in about two hours. In general appearance it is a small excavator mounted on caterpillar tractors, but on the end of the jib is a tubular arm about 5 ft. in length that carries a hammerhead weighing about 3,000 lb. The hammer is raised by a short crank lever at the end of the tubular arm, to which is connected a hoisting rope operated by the driver of the machine. The hammer is capable of delivering blows from a height of between 5 ft. and 10 ft. at the rate of 20 a minute.

The Galloway Power Scheme

Another stage in the Galloway power scheme, by which the water power resources of Southern Scotland are to be harnessed, was finished recently with the completion of the Glenlee Tunnel. This tunnel is 3½ miles in length and carries the water from a new reservoir that has been built to a hydro-electric station at Glenlee. It is of interest to note that in the construction of the tunnel more than 200 tons of explosives and 150,000 detonators have been used without a single fatal or serious accident.

Oil Electric Tug for Thames

An interesting oil electric tug, named the "*Lectro*," that has been specially constructed for towing barges on the Thames, is provided with special apparatus so that the engines and the propulsion motor can be directly controlled from the bridge. The tug is remarkable also for its quick manœuvring capabilities. It is 92 ft. in overall length, and has a beam of 22 ft. and a depth of 11 ft. 6 in. The propulsion motors consist of two six-cylinder airless injection engines of 360 b.h.p., directly coupled to 250-volt motors and auxiliary generators running at 300 r.p.m. The whole of the propulsion equipment is governed by special electrical control gear that can be operated from either of two stations on the bridge, the bridge telegraphs at these stations being mechanically connected. Details of the performance of the tug are not yet available, but we hope to include an illustrated description in the "*M.M.*" as soon as possible.

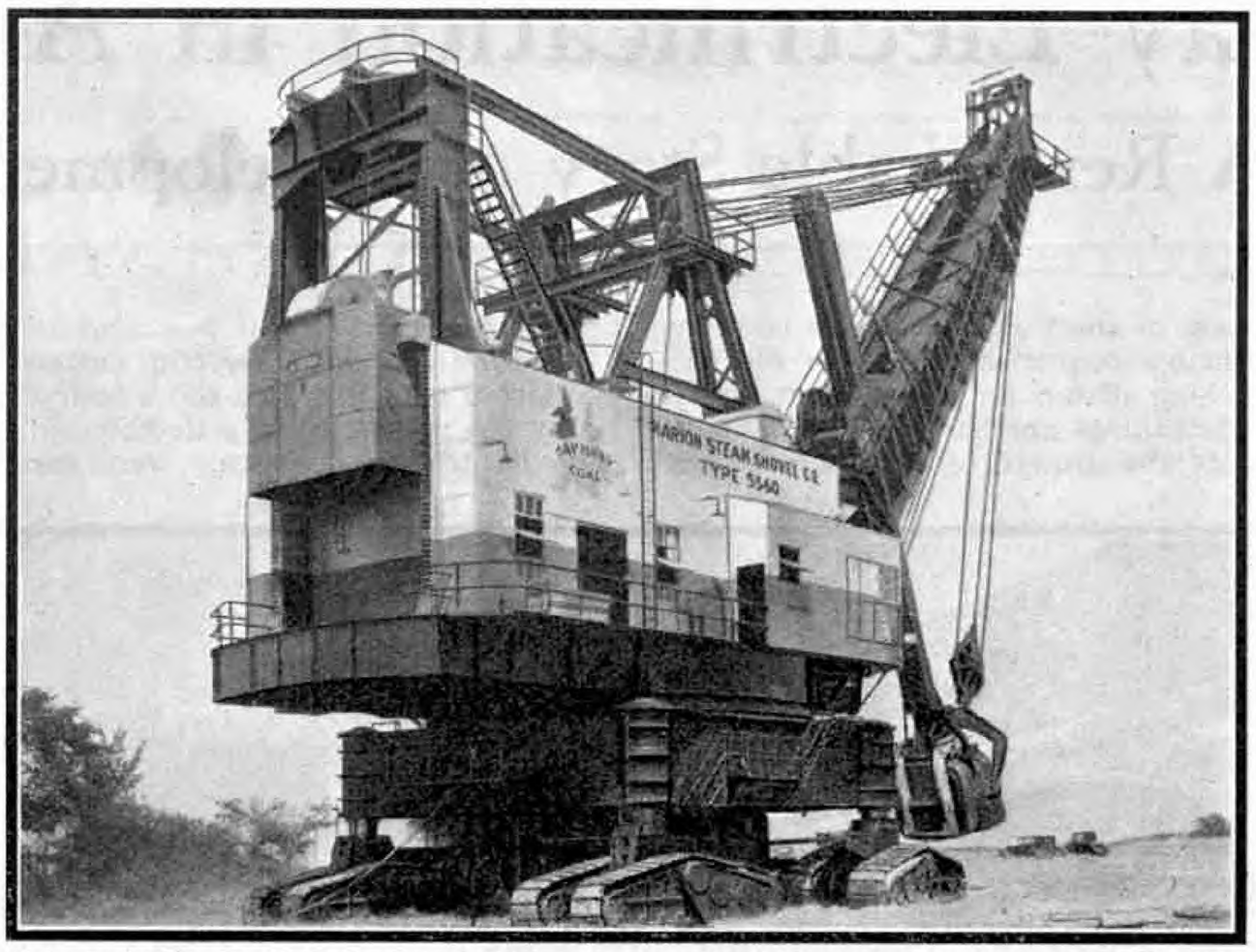
A New Stainless Steel

After eight years of research a new stainless steel alloy has been produced by the Associated Alloy Steel Company of Cleveland, Ohio, that is said to be superior to other similar alloys in a number of ways. The primary object of the exhaustive laboratory work that has been carried out was to produce a stainless steel that could be heat treated and mill processed in much the same way and with the same tools as mild steel. According to the manufacturers, the new alloy can be deformed hot without unduly straining rolls, forging presses and hammers; while full ductility is obtained at normal and annealing temperatures. The steel is described as a metal that can be freely machined, sheared, punched, perforated, sawed, and drilled by the equipment ordinarily used for such work.

A Giant Electric Shovel

A new type of electric shovel with a dipper capacity of 18 cu. yd. has been produced by the Marion Steam Shovel Company of Marion, Ohio. It is capable of picking up a 40-passenger bus from the street in front of a four-storey building, swinging it over the roof, and dropping it down at the back!

The shovel is completely electrified with the General Electric Company's "Ward Leonard" type of shovel equipment, and approximately 3,000 h.p. in electric machinery is involved. The largest motor is an 800 h.p. synchronous machine that drives a four-unit motor-generator set for converting the alternating current power supply into direct current, using a separate generator for each motion of the shovel. This type of drive is claimed to be the most satisfactory for the severe and exacting service for which the shovel was designed.



A huge electric shovel, the bucket of which has a capacity of 18 cu. yd., in operation. Photograph by courtesy of the General Electric Company of New York.

The use of a counterweight on the hoist motion is a recent development in the design of large stripping shovels that reduces the peak demands on the public service lines and enables a given electrical equipment to handle more spoil.

The shovel of the machine weighs about 1,100 tons and towers to from 75 ft. to 80 ft. above the ground. It can go through a cycle of operations in 45 seconds; in other words, in less than a minute it can scoop out 27 tons of earth, hoist high enough to clear the bank, swing around to the dumping point, dump, swing back, and lower to the digging point in readiness for another cycle. It could fill an ordinary two-car garage with spoil in three minutes.

Proposed Forth Road Bridge

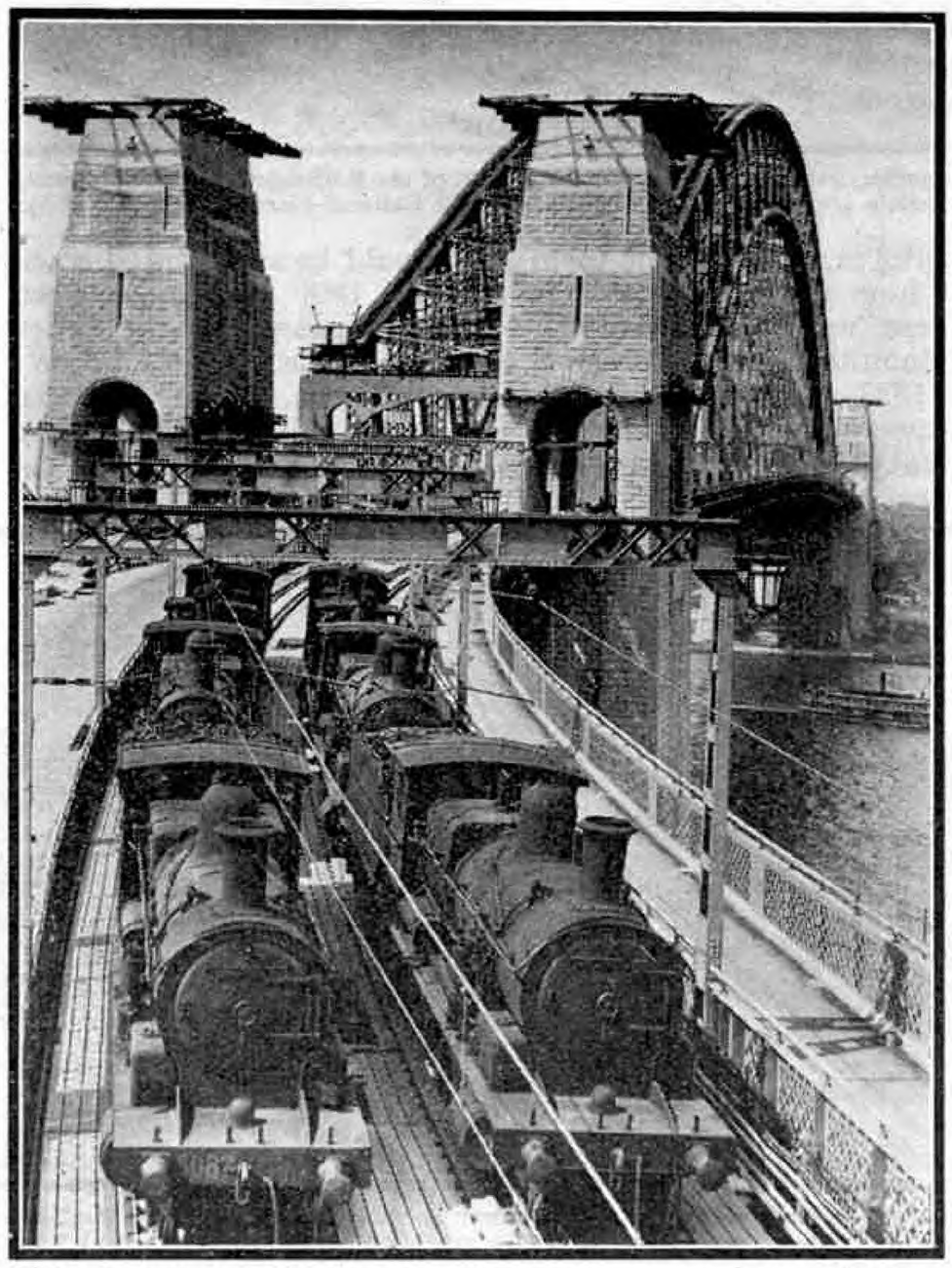
Plans for the proposed road bridge over the Firth of Forth, which has been mentioned in these pages, have now been prepared, and the Ministry of Transport have offered a grant towards its construction. The plans produced are for a bridge half a mile in length with 12 spans each of 50 ft. and two central spans each of 150 ft. These central spans would be of the pivotal type in order to allow for the passage of ships, and the roadway carried by the bridge would be at a height of about 30 ft. above water level. The total estimated cost is £327,000.

Power Station in a Dam

A power station that is being built in connection with the Janjula hydro-electric undertaking, in Southern Spain, forms part of the dam that has been erected for the scheme. This dam is of the concrete type, and is 306 ft. in height and 720 ft. in length at the crest. The power station is housed in special vaults at its base, the outer walls of these vaults being 10 ft. thick. Three vertical generating sets are included in the plant, two of them having a capacity of 7,500 kVA, while the third develops 3,750 kVA at 10,000 volts.

Ship's Hold on Land

An interesting experimental ship's hold has been installed at a laboratory of the Department of Scientific and Industrial Research for the study of biological engineering problems connected with the grading and packing of apples, and their behaviour while being carried in a ship. The hold is 34.5 ft. in length, 30.5 ft. in width, and 15 ft. in height, and is capable of holding about 130 tons, or 7,000 bushel boxes, of apples when fully loaded. It is provided with insulated walls, refrigerator apparatus and 200 thermometers.



Old locomotives coupled together being drawn across Sydney Harbour Bridge during the testing of the structure.

Canal Between Baltic and White Sea

One of the most important engineering projects yet attempted by the Soviet authorities has been brought to a successful conclusion with the completion of a canal connecting the Baltic Sea and the White Sea. This canal has been driven to save ships bound for Archangel a 17-day voyage round the northern extremity of Scandinavia, and into the White Sea by the Kola Peninsula. The canal, which is navigable along its whole length by vessels displacing up to 3,000 tons, reduces the journey to five or six days, connecting Leningrad in the south with the Port of Soroka on the Gulf of Onega, which is an arm of the White Sea.

The canal follows a chain of lakes, which were joined up, and various rivers widened. The level of one of the lakes was raised by 22 ft. and about 300 islands that were in the lake consequently disappeared. The canal is 145 miles in length and is provided with 12 locks, 15 dams and 20 sluices; and at one point on the canal it is possible for steamers to be lifted a height of 210 ft. One stretch of the work was cut through solid granite rock for a distance of 25 miles and in the whole construction more than 10,000,000 cu. yds. of earth were removed and 9,000,000 cu. yds. filled in.

No More Skyscrapers?

Leading American engineers and architects have recently made the interesting statement that it is probable that no more skyscrapers will be constructed in the United States. The reason for this startling statement is that people are now beginning to migrate from the towns into the country. This is due to the increased cost of living in large cities, which in turn is partly caused by the high rentals; while there is also a great deal of time wasted in daily transportation to and from work. Another important factor is that serious traffic problems are caused when those who are employed in the huge skyscrapers now in existence all enter and leave the buildings at about the same time.

A Long Tunnel in Africa

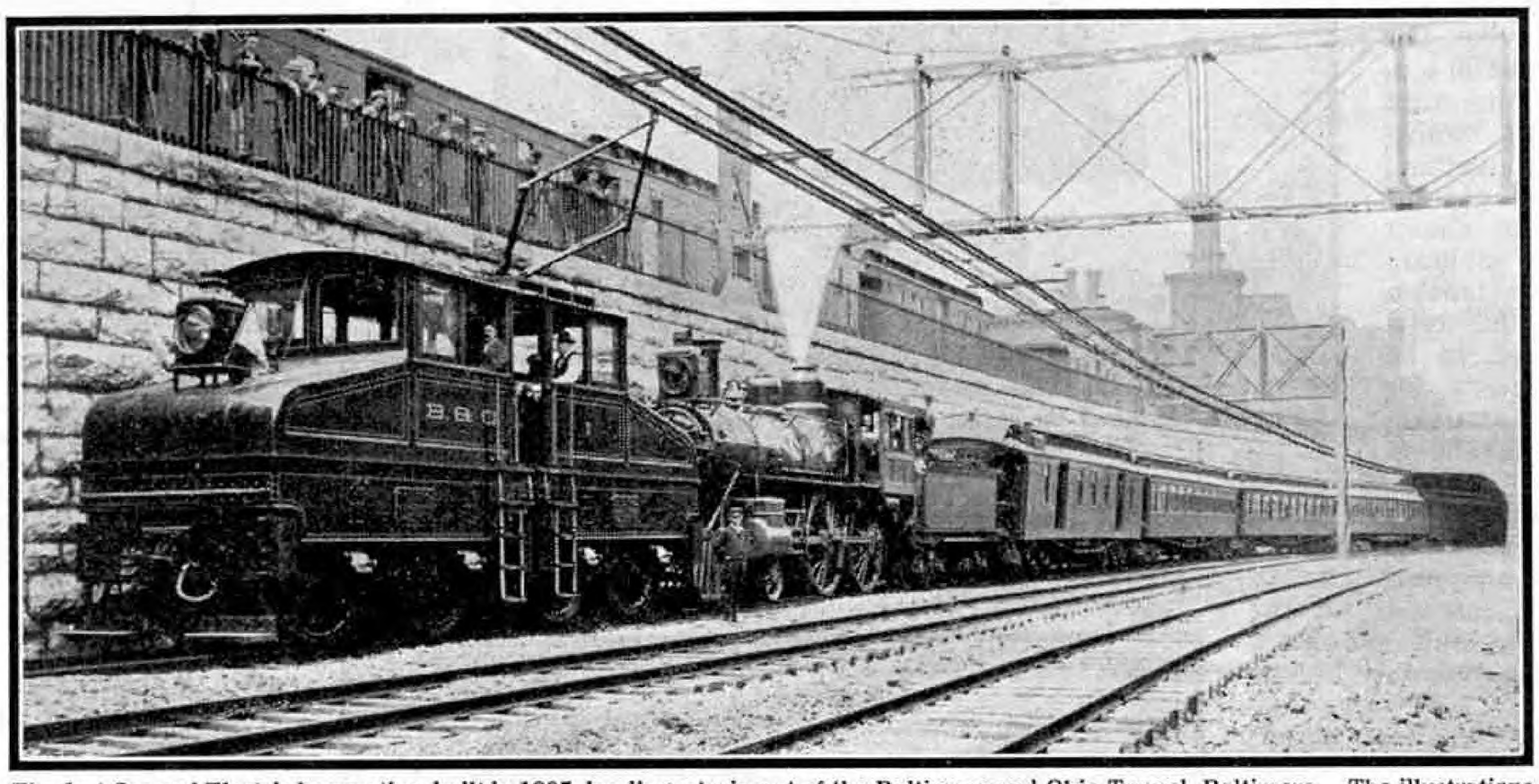
Work has now been completed on a tunnel in Africa that is about 5,280 ft. in length and pierces the Bamba mountain for the Congo-Ocean Railway. The tunnel has been driven simultaneously from both ends, and the two workings met with a difference in level of less than 4 in. The actual driving of the tunnel presented many engineering difficulties, and the work of construction had to be carried out very carefully. The greatest obstacles were water and mud, which were continuously flooding the workings. With its completion, however, the last difficulty in the construction of the railway line between Brazzavile and Pointe Noire is removed, and it is expected that the line will be ready for service by March next.

Railway Electrification in America

A Remarkable Story of Development

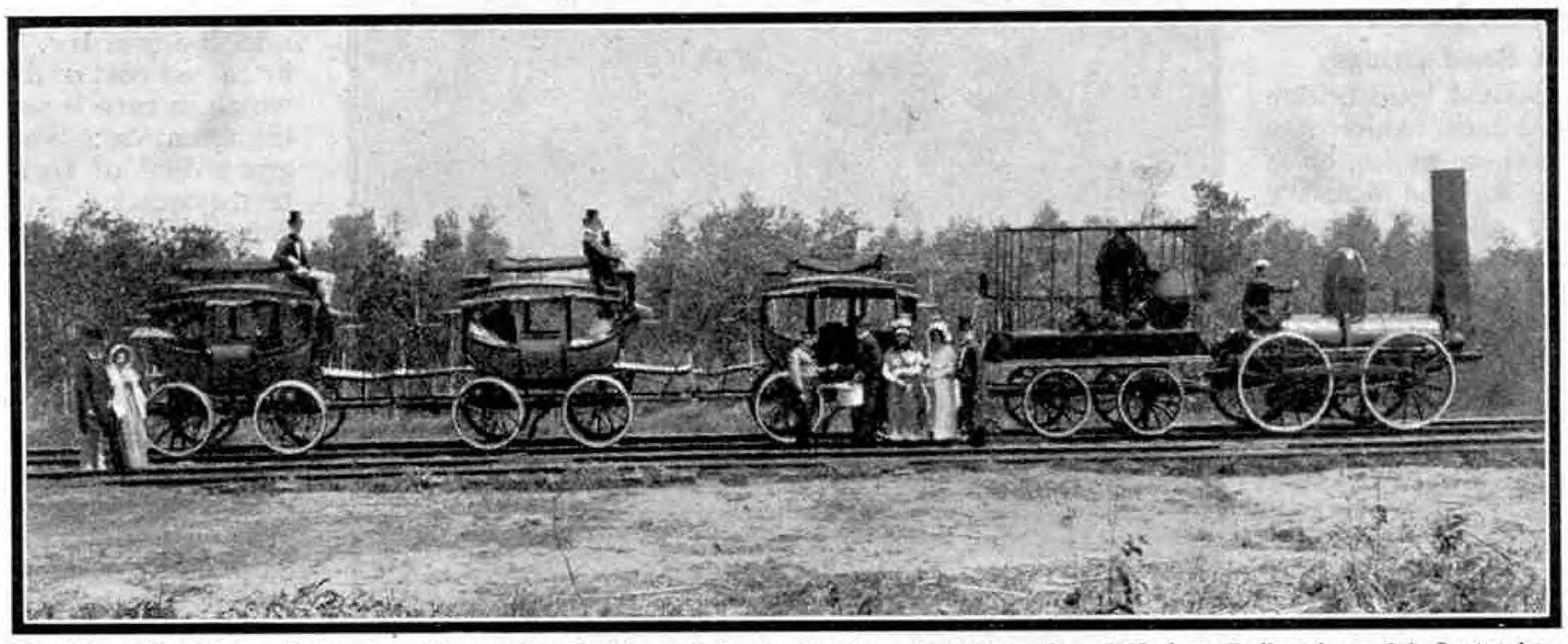
ONLY a very small proportion of the railways in this country are electrified, but in many countries there are electric railways operating over long distances, and almost every year the number of such undertakings increases. This is particularly true of America, where the growth of electric railways has been so remarkable that it is of interest to trace it from the beginning.

The coming of the first American railway may be traced to the construction of two short tramways with wooden rails, the first built at Boston in 1807 and the second in Delaware county, Pennsylvania, two years later. These were followed by several others, the most important among them being one three miles in length in the town of Quincy, Massachusetts, and another nine miles in length at Mauch Chunk, Pennsylvania. Both these were built in 1827. The first real railway in America built definitely with a purpose from the beginning was commenced in 1827 and was known as the South Carolina Railroad. In the following year the Baltimore and Ohio Company started the construction of a road from Baltimore to Ellicot, Maryland.



The first General Electric locomotive, built in 1895, hauling a train out of the Baltimore and Ohio Tunnel, Baltimore. The illustrations to this article are reproduced by courtesy of the General Electric Company of New York.

About this time a company was formed for the purpose of building a railroad between Albany and Schenectady, New York. This was named the Mohawk and Hudson Railroad. The first train was operated on it on 9th September, 1831, the locomotive being the *"De Witt Clinton,"* which weighed nearly 7,000 lb. and was placed upon two pairs of driving wheels. Behind it were three stage-coach bodies, which constituted the original cars of the line. Although this railway was crude it was evident to men of capital and of inventive capacity that it pointed the way towards a great development of railway construction. Other companies were formed in quick succession, and the railway era in the United States had fairly begun.



The "De Witt Clinton," the steam locomotive that hauled the first train on the Mohawk and Hudson Railroad, on 9th September, 1831. It is still in existence and is permanently exhibited at the Grand Central Station, New York.

In 1879 Siemens and Laske exhibited at the Berlin Industrial Exhibition the first electric railway in the world; and two years later, also in Germany, the first regular commercial electric railway was opened. In this year also Siemens operated cars at the Paris Exhibition, with electric current supplied from an overhead slotted tube in which slid a contact shoe. Power was transmitted by the motor to the axle through a chain.

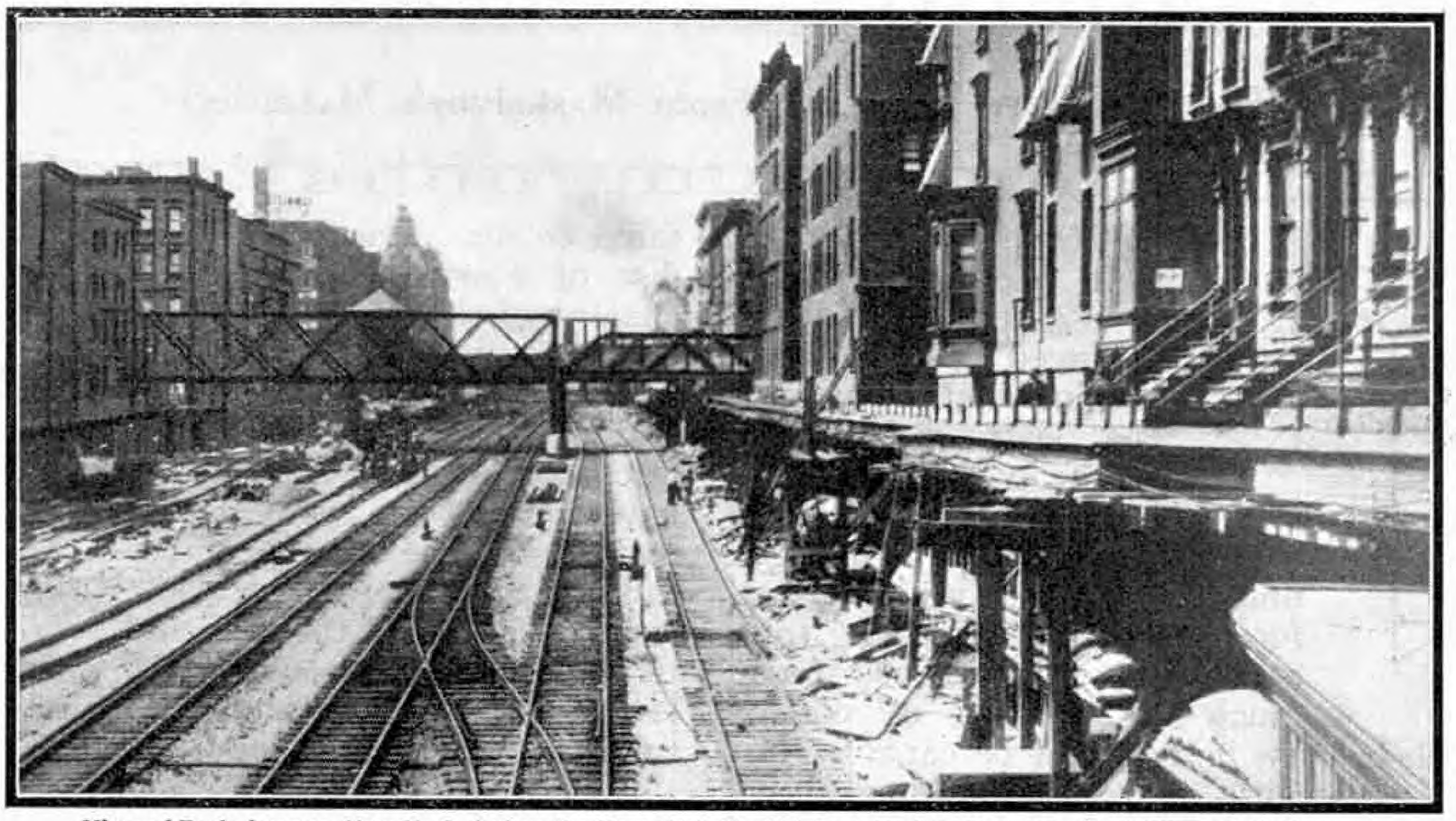
In 1887 electric cars were running in the streets of Denver, and a year later a street railway 11 miles long was installed in Richmond, Virginia, by the Sprague Railway and Motor Company, this railway being supplied from a central station with sufficient current to operate 30 cars. From that time onward Sprague and his associates laboured hard to convince the managers of street railways that electric power could be substituted economically for steam or cable traction; and by 1890 Sprague's electric lines totalled 89 with 2,080 cars. Two years later the General Electric Company of Schenectady was formed as a consolidation of the Sprague, Edison, British Thomson-Houston, General Electric and other companies.

In spite of the progress made in electric traction, Professor Bunson in his often-quoted address at Indianapolis in 1893 declared that electric railways were little more than toys and too expensive to be practical! The professor's pessimism, however, did not seriously hinder further development. In 1894 a two-mile electric railway was opened in Cleveland, Ohio. The cars of this line were the first to be operated by motors placed under the car floor, and they obtained their current from an underground circuit placed between the tracks. In the same year the overhead trolley was first introduced on a two-mile line from Baltimore to Hampden. From that time electric traction spread rapidly all over the country, and more than 4,500 miles of steam railroad track have been electrified.

The first big railway electrification project carried out in America was the reconstruction of the Grand Central Station, New York City. At this great station and in that portion of the city traversed by the railway leading to it electrification has brought about a wonderful change, one important feature of which has been the

elimination of smoke. All trains are hauled into the Grand Central from Harmon, 37 miles from the station, by electric locomotives. The elimination of the steam engine and the smoke has permitted the tracks and the terminal station to be covered in and 29 blocks of valuable property to be restored.

Going westward to Detroit on the Michigan Central Railroad another advantage of electrification is found. A few years ago it was necessary to ferry across the Detroit River, which required not less than half-an-hour. Now an up-to-date tunnel underneath the river allows the trains to continue their trip without delay or interruption, covering the distance in six minutes. This tunnel would never have been built but for electricity; for steam engines could not have been used on account of the stifling smoke, poisonous gases, soot and cinders discharged by them.



View of Park Avenue, New York, before the New York Central electrified its lines into Grand Central Station.

In these instances electricity was not used primarily to save money, but as a safeguard to health and to improve travelling conditions generally. There are, however, other railway systems that have changed from steam to electric drive for strictly financial reasons. The higher slopes of the Rocky Mountains in Montana are barren wastes, so that none of the factors that influenced electrification around New York City applied here. The Butte, Anaconda and Pacific Railroad electrified 32 miles of line between Butte and Anaconda because the change would result in a saving of a quarter-of-a-million dollars every year. The work of electrification was started in 1912 and part was in operation early in the following year. The old steam railwaymen were very doubtful and pessimistic about the change, but they became openly enthusiastic when they saw that one electric locomotive could haul 200 cars against the 96 pulled by the steam engine. The electric locomotive hauled a 55-car train up a heavy gradient at 16 m.p.h., whereas the best its steam predecessor could do was 7 m.p.h.



Photograph taken from the same point as the top illustration, after the electrification of the railroad, which runs beneath the Avenue. This shows the great improvement effected as a result of the covering in of the lines.

The success of this venture spread rapidly. The Chicago, Milwaukee and St. Paul Railway began to follow the example, and in 1913 they commenced the electrification of the Rocky Mountain Division of their line, between Avery, Montana, and Harlowton, a distance of 440 miles. This section of the line crosses three mountain ranges and includes many severe gradients, numerous curves and 36 tunnels, the longest of which is the St. Paul Pass Tunnel, 8,771 ft. long, at the top of the Bitter Root Mountains. From the summit the line descends steadily to Avery, dropping 1,675 ft. in a distance of about 22 miles. The first electrified portion of this line to be completed was the mountainous section from Butte to Three Forks, a distance of 70 miles over the Continental Divide. As additional equipment was received electrical operations were extended eastward to Harlowtown in April, 1916; and westward on the Missoula Division to Alberta in November 1916; and to Avery in February 1917.

The motive power on the 440 miles of electric road at this time included thirty 288-ton freight engines; twelve 301-ton geared passenger engines and two 70-ton shunting engines. These replaced 112 steam engines, including several of the "Mallet" and "Mikado" types. The freight engines were geared for a maximum operating speed of 30 m.p.h. and the passenger engines for a maximum operating speed of 60 m.p.h.

The electrification of the Rocky Mountain Division proved so successful that in 1919 the company electrified the Coast Division of their line, a section 207 miles long and extending from Othello to the coast cities of Seattle and Tacoma, in the State of Washington. This section crosses both the Saddle Mountains and the Cascade Range at elevations of 2,455 ft. and 2,564 ft. respectively.

Hydro-electric power is used on both divisions, in each case being fed to a series of sub-stations along the route, and from these to an overhead trolley system by means of feeder wires. Breaks, or air gaps, arranged at intervals in each trolley line divide it into sections so that in the event of any trouble developing the power can be cut off from the affected section without disturbing the remainder of the Division.

The electrification of these mountainous sections of the company's line resulted in very considerable economies. The electric locomotives on passenger service proved capable of hauling practically all the through trains over the steepest grades without the help of banking locomotives, and the locomotives engaged on freight service hauled double the loads of their steam rivals. In one year, 59 electric freight locomotives handled a volume of traffic that would have required 166 steam locomotives, and effected a saving of 237,000 tons of coal and approximately 32,600,000 gallons of oil.

In addition to the general saving electrification carries another great advantage on this road, which passes through a severe weather area. In the Rocky Mountain region it is not uncommon for the temperature in the winter months to drop to 35 or 40 degrees below zero. Under such conditions it would be difficult for a steam engine to operate on a level track, and next to impossible for it to haul a load up a stiff grade. With the electric locomotive, however, the severest

(Continued on page 947)

Puzzle Your Sharp-Eyed Friends

Simple Conjuring Tricks for Christmas

By Norman Hunter (From Maskelyne's Mysteries)

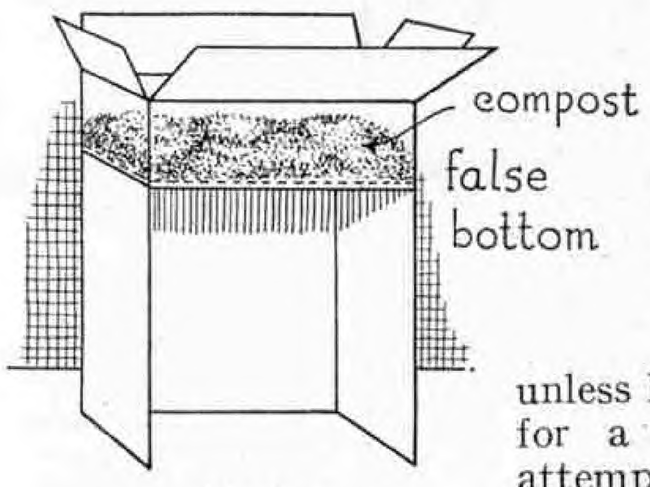


Fig. 1.

HERE are some more new tricks specially arranged to give the maximum effect, with the least difficulty, to the performer. It is really a mistake for the amateur conjurer unless he has been performing for a considerable time to attempt tricks that call for much in the way of skill. This is not so much because he may not be capable of working the tricks as because, in presenting them, he will have to think too much about what he is *actually* doing, and therefore will not be able to give sufficient attention to what he is *supposed* to be doing. Tricks that are easy to do leave the conjurer free to concentrate on making his presentation convincing and entertaining.

First of all a novelty in the way of flower growing by magic.

THE BEWITCHED BULBS

The wizard shows a shallow bowl to be empty, and fills it with some special compost sold for growing bulbs. This need not necessarily be the real thing, although it probably will be just as simple to use the actual material as to find a substitute. He plants a few bulbs in the bowl, and covers it with a tube of black paper, first allowing the spectators to look through the tube and satisfy themselves that it is empty.

The bulbs are now watered by way of the tube with a tiny toy watering can, and an electric torch is shone on the tube to represent sunshine. When the tube is lifted the audience see a number of beautiful tulips growing in the bowl!

The Secret. The compost is in a cardboard carton, the bottom of which has been moved up to within a few inches of the top. The upper part only of the carton is filled with compost, and the back of the carton below the false bottom is neatly cut away. The carton stands on the table, with the open portion to the rear, in which position there is nothing to suggest to the audience that it is other than ordinary (Fig. 1).

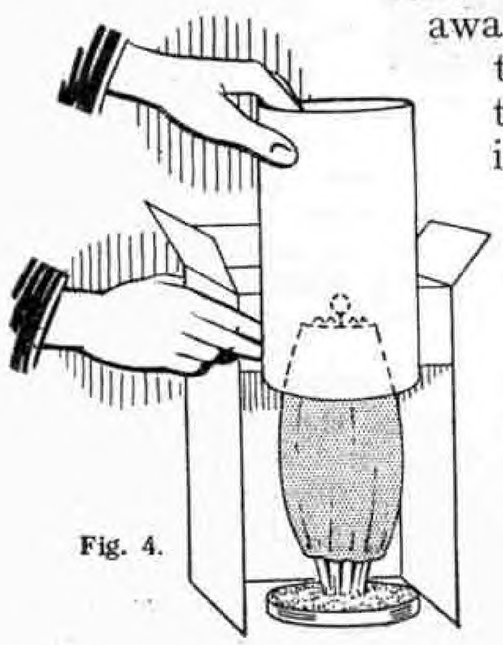


Fig. 4.

Concealed in the vacant space under the carton is a specially-made group of artificial tulips, complete with leaves. These can be bought at almost any fancy shop, and as the tulips are supposed to be grown from different bulbs they need not all be of the same colour. The stems are fixed into a disc of wood rather smaller than the opening of the bowl. This disc must be heavily weighted by screwing a flat piece of iron or lead to its underside. The upper side of the disc is painted black, and may have some of the compost glued to it. In the centre of the tulips there is a stiff wire rising from the centre of the disc, and terminating in a loop that is about level with the bloom of the centre tulip (Fig. 2).

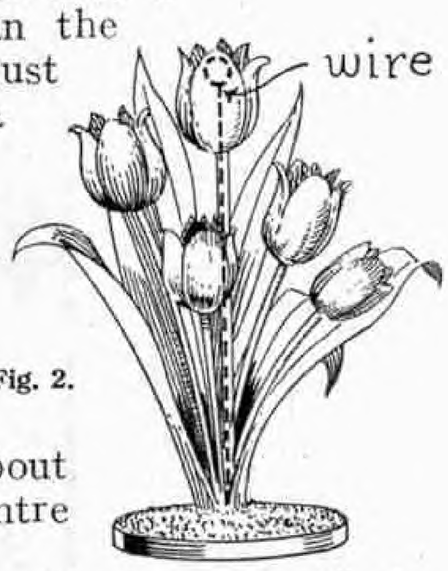


Fig. 2.

Over this plant is fitted a sort of bag of thin black cloth, open at both ends, and arranged to keep the tulips pressed together (Fig. 3). When the bag is pulled off the springy nature of the wire stems will cause the tulips to bend downward and thus make a bigger display.

To perform the trick, first show the black paper tube, and explain that it is made of a special fertilising paper. Let everyone see that it is empty. With your free hand move the carton of bulb compost forward on the table, and at the same time put the tube down behind it and so over the hidden plant (Fig. 4). Now show the bowl, fill it with compost, and plant the bulbs. Handle the carton carefully, so as not to expose the open back or bottom.



Fig. 3.

Lift the tube with the thumb outside and the fingers inside. Hook one finger in the wire loop, so that you are able to pick up the concealed plant inside the tube. Stand the tube on the compost in the bowl, and the weighted disc will then rest snugly on the surface. Now have some fun with your miniature watering can and artificial sun. Then lift off the tube, nipping the edge of the bag against the inside of the tube, and so draw the bag away. Thus freed from all restraint the tulips will expand and will look quite natural.

Now for a very puzzling little trick with a piece of ribbon and a pair of scissors.

THE CAREFUL SCISSORS

The conjurer shows a long piece of ribbon, a pair of scissors, and an envelope of foolscap shape. To prove that the scissors are sharp he cuts off a few snippets from the end of the ribbon. He then snips off the closed end and the flap of the envelope, so converting it into a sort of paper tube. Through this tube he passes the ribbon, and invites two spectators each to hold one end of the ribbon. Now taking the scissors he deliberately cuts right across the envelope, and

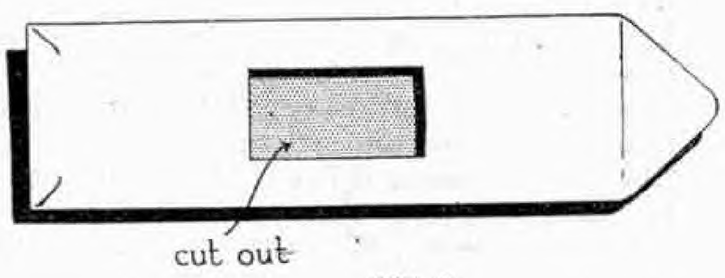
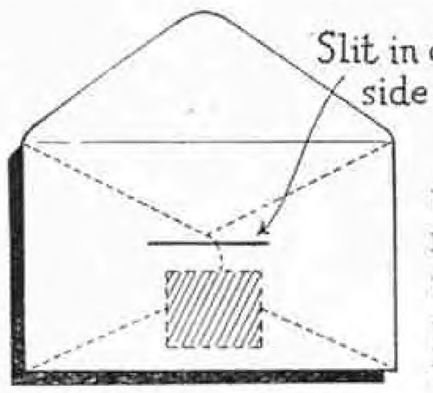


Fig. 5.



Dummy packet stuck to non-address side of envelope (inside)

Fig. 8.

obviously the ribbon also must be severed. These are careful scissors, however; they cut the paper but save the ribbon. The wizard draws apart the cut halves of the envelope, pulls out the ribbon, and shows that it is still whole and perfect.

The Secret. Ribbon and scissors are quite ordinary. The ribbon should be fairly wide for the sake of effect, and about two yards in length. Before the performance prepare the envelope by cutting from the centre of the address side a piece about 3 in. long and a good deal wider than the ribbon (Fig. 5).

To perform, having shown the ribbon and snipped pieces off to prove the sharpness of the scissors, cut off the ends of the envelope and pull the ribbon through, holding the envelope all the time with the cut-out part at the back. Have the ends of the ribbon held by two people, and ask them to pull on the ribbon and keep it taut. Now bend the ends of the envelope back, and you will find that the centre of the ribbon will come out through the cut-out space.

Take the scissors and cut across the envelope from side to side. As you are holding the envelope lengthwise and flat to the audience you will be cutting vertically, and you will find it quite easy to cut the envelope while allowing the ribbon to pass behind the scissors (Fig. 6). Hold the cut ends of the envelope and draw out the ribbon. While the ribbon is being inspected you have ample time to tear up and dispose of the envelope.

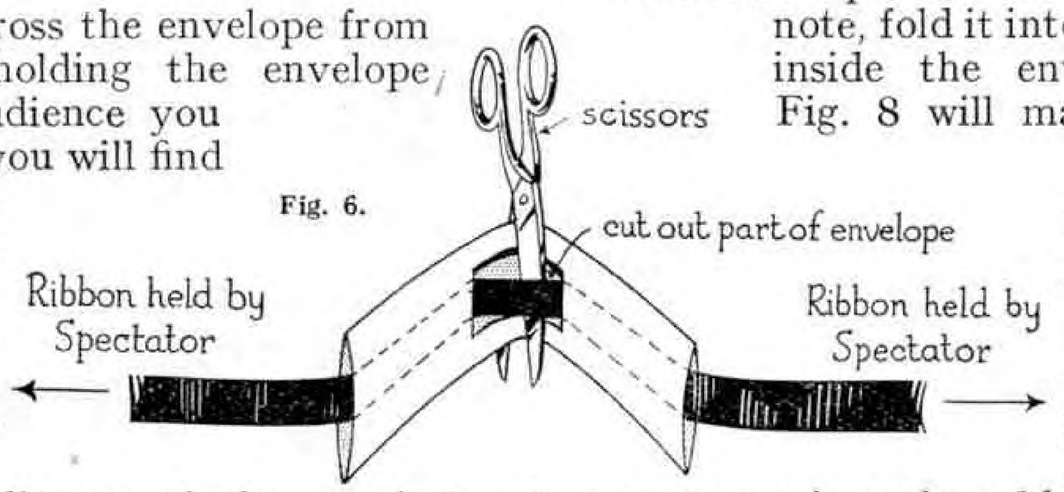


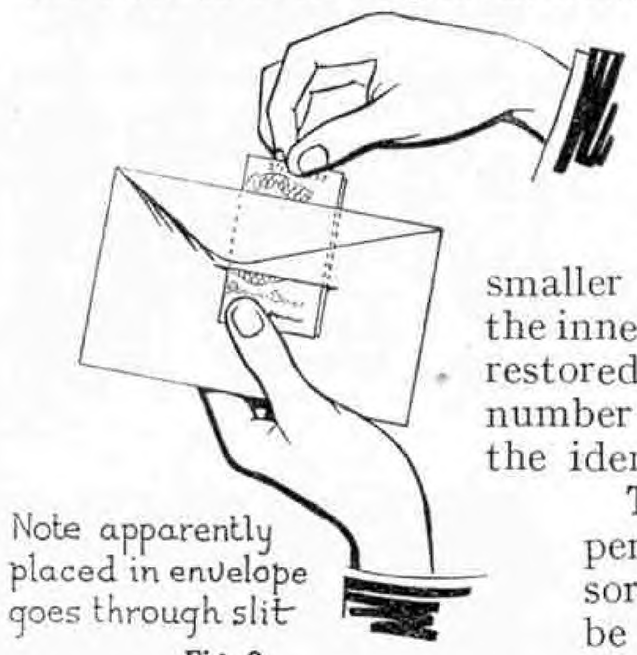
Fig. 6.

While we are on the subject of envelopes for conjuring let me explain a rather exciting trick that can always be relied upon to cause a sensation.

MONEY TO BURN

A ten shilling or pound note is first borrowed from a member of the audience, and before the owner parts with the note he is asked to make a record of its number. The conjurer then folds the note into a small packet, seals it in an envelope, and holds the envelope in front of a candle flame, so that everyone can see the shadow of the note. Then he moves the envelope into the flame, and allows both it and the note to be burned to ashes!

The worried expression on the face of the lender of the note is soon dispelled, however. When he opens a small box that he has been given to hold at the beginning of the trick, and which has never left his hands, he finds inside a series of smaller and smaller boxes. In the innermost of these is his note restored whole, and from the number he can verify that it is the identical one that he lent.



Note apparently placed in envelope goes through slit

Fig. 9.

The Secret. You may perhaps feel that this is the sort of trick that it will be well to practise with a piece of plain paper before venturing on it with a real note. Actually, however, there is not the slightest danger of the money being harmed.

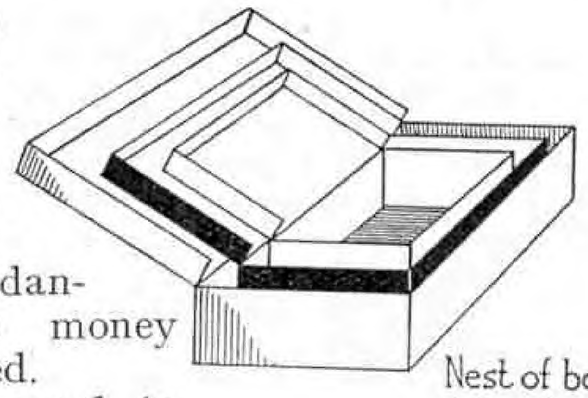


Fig. 7.

Nest of boxes open ready to be closed all together

You will need in addition to a candle and matches a nest of small boxes. About five or six will be enough, and they should have hinged lids. Open them all, and place them one within the other. You will now find that if something is placed in the innermost box and the entire nest closed like a book, all the boxes will be shut at once, though each will have to be opened separately (Fig. 7). Have this nest of boxes ready open inside a hat, or behind a screen.

The envelope used is prepared first by making a slit about 1½ in. long horizontally on the address side. The envelope should be an ordinary one of business shape, and the slit should be made in the centre just below the point of the V-shaped opening on the flap side, that is the side on which the address is not written (Fig. 8).

Now take a piece of thin paper the size of a ten shilling note, fold it into a small packet, and gum it just inside the envelope against the flap side. Fig. 8 will make this clear.

Now to perform. Having borrowed your note fold it into a packet approximately the same size and shape as your dummy. Pick up the prepared envelope, and hold it with the address side to the rear. The thumb of the hand holding the envelope presses against the address side below the slit. Insert the folded note into the envelope, but see that the lower edge of the packet goes just through the slit and out at the back (Fig. 9). Moisten the flap with your finger and seal the envelope. Now take the envelope from one hand with the other, and in doing so draw the folded note through the slit and keep it held in your hand while you lay the envelope on the table, or prop it against the candlestick.

Now fetch your nest of boxes, slip the note into the innermost box, close the lot, and ask the owner of the note to hold this box carefully throughout the trick.

Light the candle, and hold the envelope in front of it, when the dummy paper will make it appear that the real note is still inside. Burn the envelope and the rest is easy.

Now for a card trick with a surprising finish.

ABOUT TURN

A card is chosen from the pack. The chooser looks at it and returns it to the pack, which may then be shuffled. The magician tells his audience that it is really an easy matter for a conjurer to tell which card has been selected because it always gives itself away. He spreads the pack out face downward on the table, and the audience see that one card has turned round

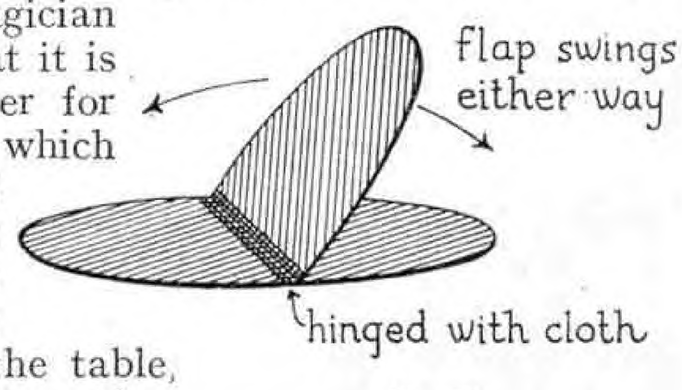
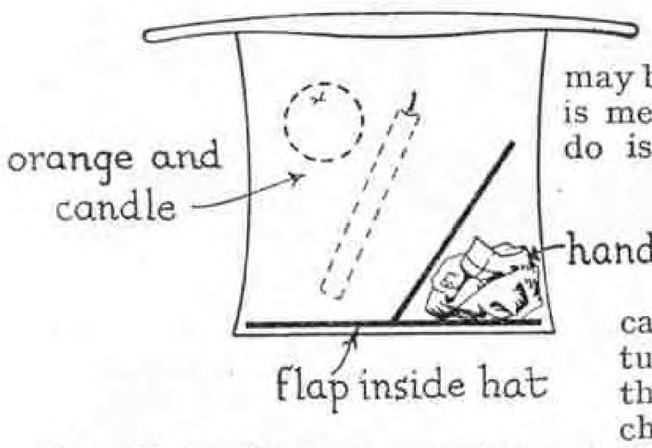


Fig. 10

Fig. 11.



and is face upward. This proves to be the chosen card.

The Secret. Any card may be chosen. While the chooser is memorising it, all you have to do is secretly to turn over the bottom card of the pack and then turn the pack over. You can do this very easily by turning with your back to the audience, so that the chooser of the card may show it to the other spectators without your seeing it.

Present the pack for the return of the card. You now have all the cards except the top one face upward, but the top card being back upward makes the pack appear to face downward; and as nobody knows what is to happen everyone assumes that the card is put into the pack the same way up as the rest. Be careful to hold the pack low down, so that the underneath of it cannot be seen, and keep the cards firmly together, so that the fact that they are face upward is not noticed.

While you are informing the audience how easy it is for a magician to tell what card has been chosen, take the reversed top card off the pack, at the same time turning the pack over in your hand. Wave the card about as though demonstrating your explanation, and then put it back on the pack facing the same way as the others. You can now spread the pack out on the table face downward, and the chosen card will of course appear face upward!

Next an interesting and showy little trick.

ORANGE AND WHITE

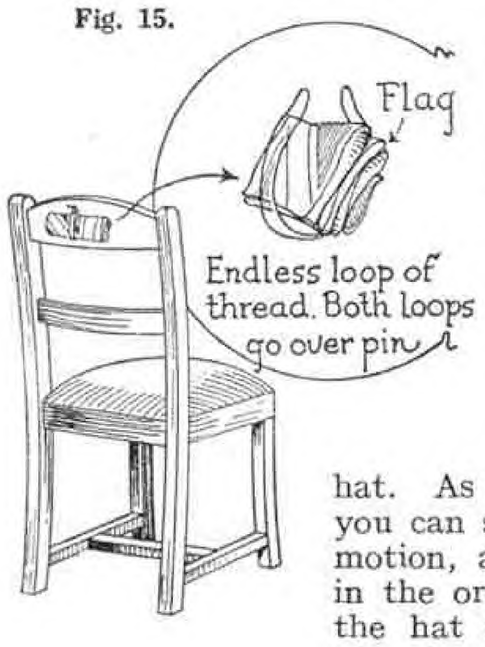
From the flame of a candle the conjurer produces a small orange which, with the candle, he throws into a hat. He then turns the hat over and out drops a white handkerchief with a big orange spot in the middle, presumably made out of the orange and the white candle.

The Secret. The candlestick in which the candle is held must be of the kind that has a good big hollow space under it. If you do not possess one of this kind it is easy to make one by fixing the top part of a wooden candlestick to a small bowl turned upside down. Paint the whole affair some bright colour, and if you like add a handle at the side.

The orange, or perhaps better, a tangerine, is under the hollow candlestick. Pick up the candlestick with the right hand, slipping a finger underneath to prevent the tangerine from falling. Draw attention to the candle flame, and point with the left hand to an imaginary orange spot on the flame, allowing everyone to see that this hand is empty. Now transfer the candlestick to the left hand, but keep the tangerine held between the fingers of the right hand, which may be curled quite naturally round it. Run the tips of the right-hand fingers quickly up the candle, and bring the tangerine to the finger tips as they reach the flame. The illusion of picking the tangerine from the flame is perfect.

The hat in which the change takes place has in it a special contrivance shown in Fig. 10. This is an oval of blackened cardboard cut to fit snugly into the bottom of the hat. Hinged across the middle of this oval is another piece of blackened card forming a flap. This flap must be trimmed to a curve at the top, so that when moved to either end of the hat it will fit fairly closely round the curve of the crown. Thus you have a swinging partition dividing the hat.

Fig. 15.



Previous to the show take a big white handkerchief—it need not be silk—and either sew or paint a large orange disc in the centre. Fold up the handkerchief, place it in the hat and move the flap over to hide it.

Having produced the tangerine, blow out the candle and pick up the hat. Hold it by the end where the flap rests, fingers inside the hat. As long as the lining of the hat is black you can show the hat empty with a swinging motion, and hold it upside down. Now drop in the orange and the candle (Fig. 11). Take the hat in the other hand, moving the flap over as you do so to hide the orange and the candle. Turn the hat over, and out drops the handkerchief, the orange and candle apparently having become transformed.

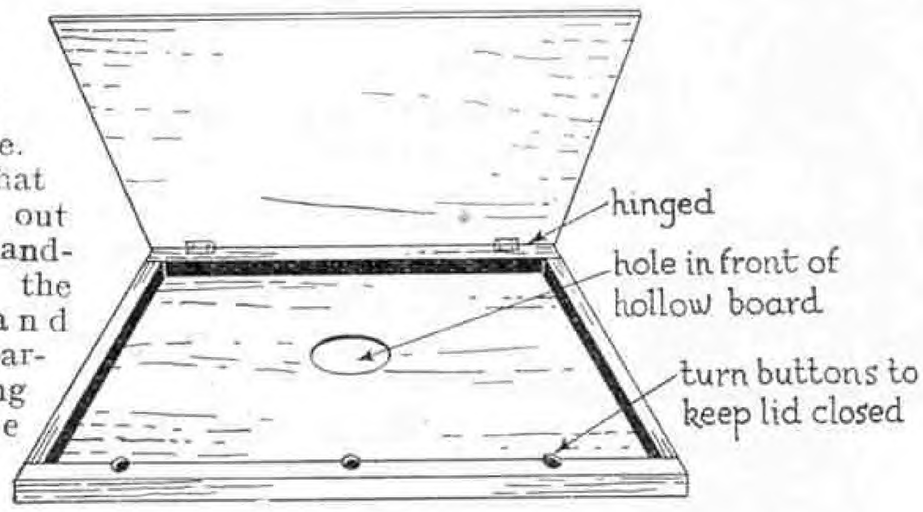


Fig. 12.

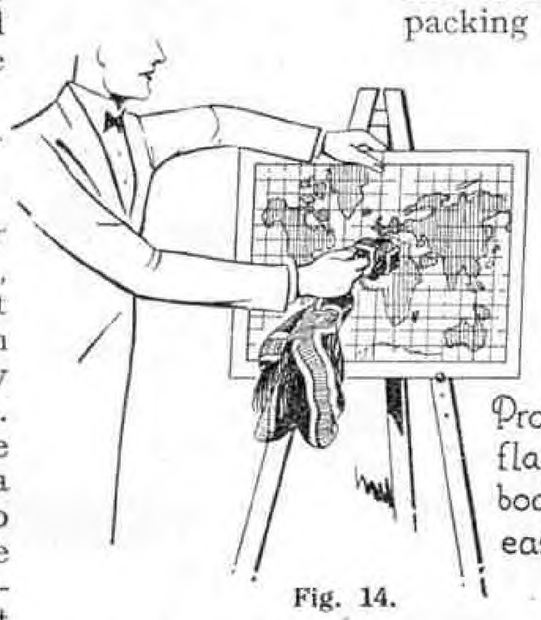
For the last trick in the performance there is nothing more effective than a production of flags.

THE MAGIC MAP

A board is shown on both sides, and a paper map of the world is pinned to it. Immediately the magician pushes his fingers through the map and produces flags of all nations, finishing of course with an extra big Union Jack.

The Secret. The board is really hollow. To make it construct a frame about 18 in. by 12 in. from inch-square strips of wood. Nail a piece of cardboard, or very thin fretwood, to one side, and hinge a similar piece to the other side. It is necessary for the back of the hollow board to be hinged in order to make the packing in of the flags easy. In the front of the board cut a hole about 2 in. in diameter (Fig. 12).

To prepare, take the flags and lay them in the hollow board one on top of the other, putting in first the flag you wish to produce first, and so on. The flags should be inter-folded, as shown in Fig. 13. Then when you pull the first one out through the hole part of the next one will follow it, and so on right to the end. When all the flags are in fasten on the back and paste thin brown paper over the front of the board to hide the hole.



Producing flags from board on easel

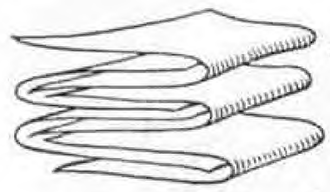
Fig. 14.

Show the board on both sides. You can bang the edges or corners on the floor and they will sound solid. Take your map, which can be just a rough tracing on tissue paper coloured with inks, and pin it to the board with drawing pins, taking care to fasten it to the front of the board. Now tap sharply on the paper covering the hole, break the paper, and draw out the flags. It is a good plan to have an assistant to hold the board, so as to leave you with both hands free to display the flags. Failing an assistant a small easel will serve very well, but in this case the board should be held against the easel with one hand, while the other hand draws out the flags (Fig. 14).

In either case as you produce the flags drape them over the back of a chair. Behind the chair, and hidden by a fancy cloth, or by the top rail of the chair if it is wide enough, is suspended a big Union Jack folded in pleats and held with a loop of thread as shown in Fig. 15. This is hung on a pin fixed on the back of the chair. When you have produced all the flags from the map gather them up from the chair, and pick up the big one from behind the chair. Grasp the rings sewn to the corners of the big flag and shake it open, at the same time allowing the other flags to flutter to the floor.

The tricks that I have described will appeal particularly to "*M.M.*" readers who do not wish to spend much money on apparatus. With the exception of the artificial tulips, the various appliances required are such as can be made at home easily and cheaply.

There are two important points that should be borne in mind by all who adopt the role of conjurer. The first point is the necessity of practising each trick a few times in private before performing it before even the smallest audience. Success depends entirely upon carrying out the trick in an easy and natural manner, and this cannot be accomplished unless every movement is familiar. Second, if at all possible avoid repeating the same trick before the same audience, as however efficiently you may "carry it off," the audience know what is coming and thus have a good chance of discovering the secret. The attention of the audience can be effectively diverted at critical moments in the performance by a few witty jokes and sayings, which should be memorised thoroughly, so that they may be spoken easily and naturally.



How flags are inter-folded

Fig. 13.

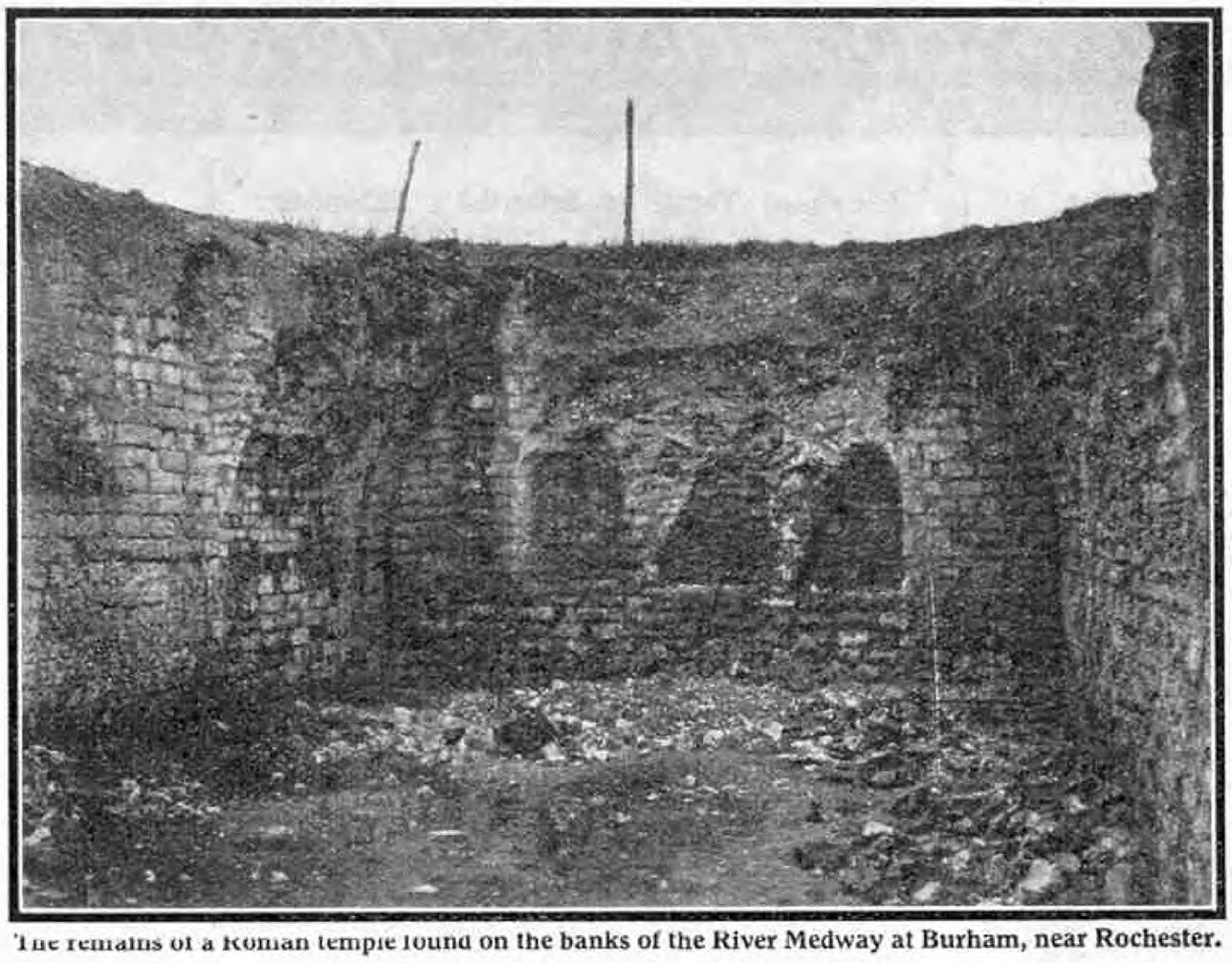
A Roman Temple by the River Medway

The Worship of Mithras

By W. Coles Finch, M.I.C.E.

THE Roman era in Britain lasted nearly 400 years, from A.D. 43 to A.D. 410; and during this period great changes were wrought. The remains that come to light from time to time of domestic dwellings with mosaic floors, baths, and other indications of wealth and refinement, prove that although Britain was never as thoroughly Romanised as other parts of the great empire, yet compared with the rough uncultured Britons the Romans had travelled far along the road to civilisation.

It is not proposed to enter into the work of the Romans in connection with roads, bridges, fords, military works, amphi-theatres and public buildings. The Medway valley is rich in records of these things, but the subject is too vast to be treated here. In the matter of Roman religious buildings, however, the banks of the Medway yielded a rare and interesting example in the form of a fine Mithraic temple, standing on the very margin of the river at Burham, near Rochester. It was discovered in 1894, but was ruthlessly destroyed to provide room for the erection of a kiln for making lime; and to-day on the very spot stands a high square chimney shaft, belching forth columns of dense black smoke. Its destruction was absolute desecration, for the rites practised in this buried Roman temple paved the way for the Christian faith of to-day.



The remains of a Roman temple found on the banks of the River Medway at Burham, near Rochester.

The temple was constructed in a sandbank sufficiently cut into to admit of the whole structure being below the surface level. This was always the custom in such cases, the intention being that the temple should represent a cavern. Even the entrance was by means of a narrow zig-zag passage, so that the natural light should be excluded. The masonry supporting the sides and the arched roof of the structure was of squared blocks of chalk rock, those of the side walls being carved with a series of vertical chevron marks. Examples of the same kind may be seen in the Museum at Maidstone.

The religion of Mithras is one of the mysteries of history, for we have no adequate record of its beliefs or ceremonies. Mithras was a semi-divine warrior, the god of light; and we find depicted on most Mithraic monuments a torch held upward to represent the rising of the Sun, and downward to represent its setting. Mithras was a soldier god, and in the second and third centuries became the centre of a popular form of worship. Hence these temples were constructed in practically every locality where there was a garrison town, after the time of the Julian emperors.

In Graeco-Roman art Mithras is depicted as kneeling on a prostrate bull, in the act of plunging a dagger into its neck, the scene always being enacted in some kind of cave or grotto. This was the mystic Mithraic sacrifice.

In the course of demolishing this temple there were found pottery, tiles, bones of horse, wild bore, ox, and red deer, and a coin of the Constantine period. From every point of view the destruction of this interesting relic of Roman worship is certainly to be regretted.

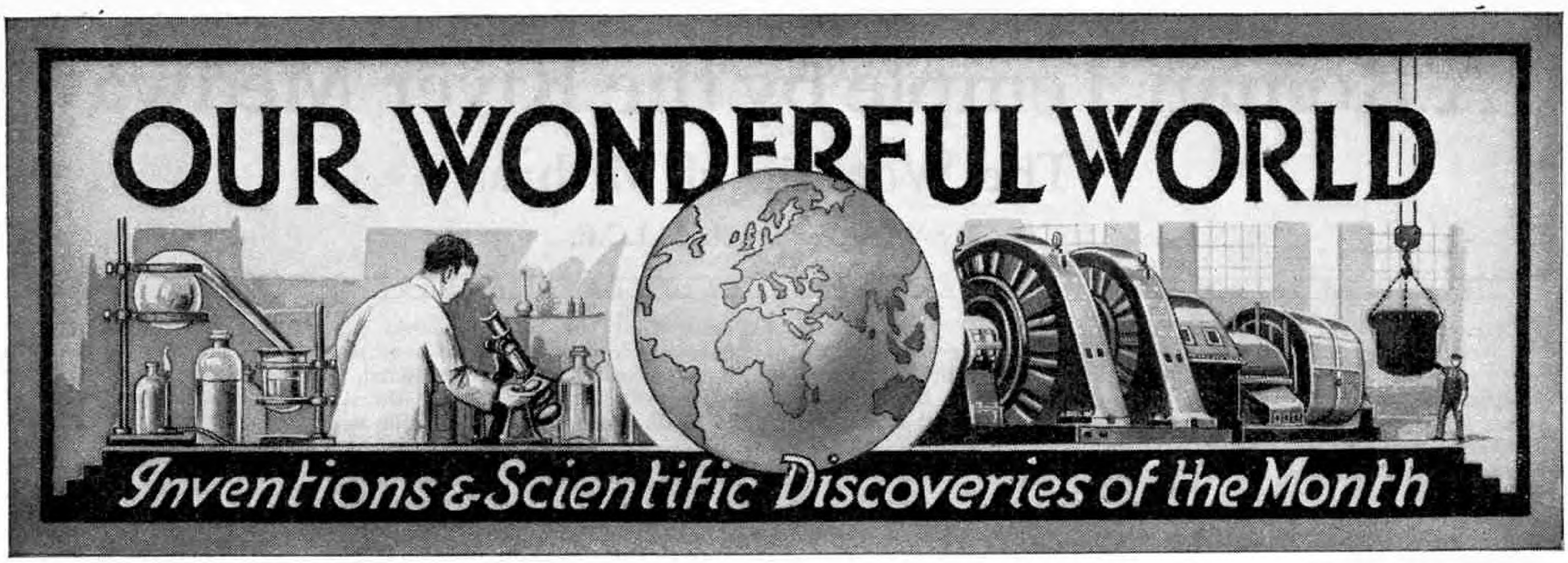
Rail Electrification—(*Continued from page 943*)

cold has no effect, and its efficiency is in no way impaired by inability to obtain fuel or water in case of snow blocks.

Another important advantage of electric railways is the possibility of recovering energy on the descending grades by reversing the usual function of the motors and using the momentum of the train to drive them as dynamos. This "regeneration," as it is called, provides an interesting solution of the problem of braking. On the long-sustained grades encountered in crossing mountain ranges great skill is required to handle either the heavy freight trains or the high-speed passenger trains by means of the usual air brakes. The entire energy of the descending train must be dissipated by the friction of the brake shoes on the wheels. For instance, in order to control a 2,500-ton train travelling at 17 m.p.h. down a two per cent. grade, 4,700 h.p. must be dissipated; and using the ordinary air brake it is not surprising that the brake shoes should become red hot and compel trains to wait until they cool down. With the regenerative braking of the electric train the motors become generators that absorb the energy of the descending train, thus restricting the train to a safe down grade speed, and at the same time returning electric power to the trolley for use by other trains. There is therefore a considerable saving in the wear and tear of brake shoes and equipment. The electric braking mechanism automatically controls the speed by regulating the amount of energy fed back to the line.

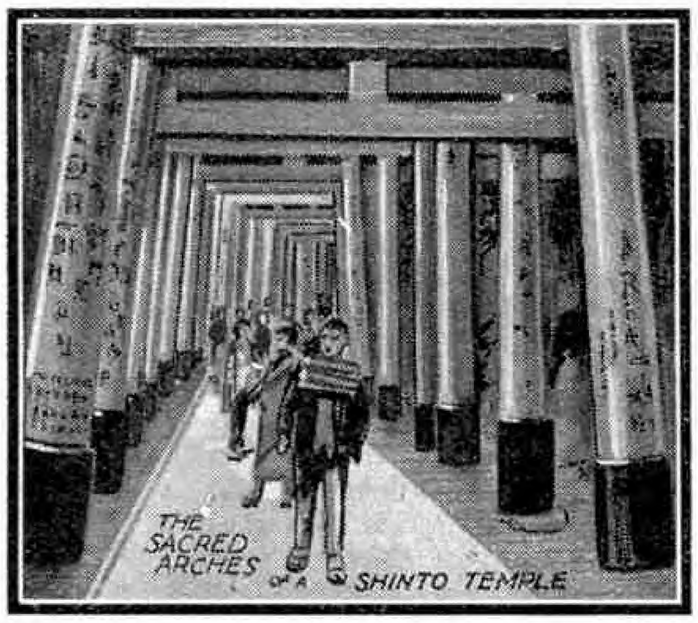
Since the electrification of the Rocky Mountain and Coast divisions of the Chicago, Milwaukee, St. Paul and Pacific Railroad several other important main line electrifications have been completed in various parts of the United States. One of the most important of these schemes was the completion in 1929 of the Great Northern Railway's new Cascade Tunnel, $7\frac{3}{4}$ miles long. A detailed description of this great tunnel was given in the "*M.M.*" of October 1931, but we may repeat here that the tunnel shortened the company's line through the mountains by almost nine miles, eliminated $18\frac{1}{4}$ miles of 2.2 per cent. gradient and lowered the car elevation of the line 502 ft. With the completion of the tunnel and new line the whole section between Appleyard and Skykomish, in the State of Washington, was changed over to electrical operation at a cost, including the purchase of 14 electric locomotives, of approximately £1,200,000. By these improvements the running time of passenger trains on this route has been reduced by one hour and that of freight trains by three hours.

Though much of the railway electrification in America has been on the mountain sections of important routes, electrification has played a notable part also in solving the transport problem of New York City. There are trains that run on the ground, above the ground and below the ground, and trains that run over the water on bridges, and under the water in tunnels. There are trans-Continental trains and suburban trains, all electrically propelled, lighted and heated. Electric signals inform the motormen when the doors of the trains are closed; electric block systems automatically stop the trains in emergencies; electric fans cool the subway cars; and each express train has 2,400 h.p. of electric motors.



A Lightning Tour of the Far East

The first of the small illustrations on these pages shows worshippers passing under the sacred arches of the Shinto temple of Inari, one of the most popular of the gods worshipped in Japan, in order to lay their offerings at the main shrine.



Shintoism and Buddhism are the chief religions of the Japanese. Shintoism is commonly called ancestor worship, and its shrines differ from those of Buddhism in their greater simplicity.

The next scene is in Korea, which has been described as the land of hats, for every occupation and station in life appears to have its particular hat! The type in most common use is a straw hat, shaped like a pyramid, with a wide brim. This kind of hat is worn by the sedan chairman shown in our illustration, and the teacher on the right wears one resembling a small top hat, secured by wide tapes passing under the chin.

Our third illustration shows a typical Chinese shop. This is open to the street, and passers-by may see in it workmen busily engaged in making the various articles offered for sale.

The glimpse of Burma in the last of these small pictures shows a very ancient means of transport—the bullock cart. The cart shown is a very elaborate one, but no amount of care spent on decorating it will increase the speed of the slow and heavy-going bullocks harnessed to it!

Burma is the land of pagodas, and the Shwe Dagon in Rangoon, the greatest of these, is one of the wonders of the world. It is a pyramidal structure, 370 ft. in height, gilded up to its tapering summit, and four hairs from the head of Buddha himself are preserved in it.

Elephant Teeth as Scientist's Calendar

From time to time fossil remains of very primitive human beings have been unearthed in different regions of the earth, and there have been many disputes as to their respective ages. As explained in the articles on "*The Story of Prehistoric Man*" that appeared in our issues for September and October this year, relics of this kind that have been almost universally regarded as the oldest known were found in Java, and fossilised skulls of representatives of a race that was believed to have flourished a little later have been discovered in Peking. A few fragments of the skull of the earliest known inhabitant of Great Britain were unearthed at Piltdown, Sussex, and Professor H. F. Osborn, a famous American scientist, recently startled other experts by the assertion that Java Man was really much later than Peking Man, and that Piltdown Man was older than both.

Professor Osborn formed this conclusion by studying a calendar in which teeth marked the passing of centuries. Elephant teeth, whether those of living animals or extinct creatures, have ribbed surfaces, the hard enamel forming a series of waves on the top of the gigantic molars. The teeth of the modern elephant are much more wavy in outline than those of its predecessors, and the more primitive the elephant, the less serrated are its teeth. Judged by this scale, an extinct elephant, fossil teeth of which were discovered in the same geological deposit as the skull of Piltdown Man, was earlier than similar creatures associated with Java Man and Peking Man, and this gives pride of place to Britain's earliest human being.

According to Professor Osborn, Piltdown Man dates back to a little more than 1,000,000 years ago; Java Man flourished only 600,000 years ago, and Peking Man was in his prime about 250,000 years earlier. The creature whose remains were discovered in Java was much more apelike than the others, and this is explained by supposing him to be the last degenerate survivor of his race.

* * * *

The Dead Sea is believed to be one of the richest sources of chemicals in the world. Its waters contain potash salts, from which valuable plant foods can be made, and many other substances of great commercial value. These can be extracted cheaply, for the liquid containing them can be concentrated by making direct use of the heating effects of the Sun's rays.

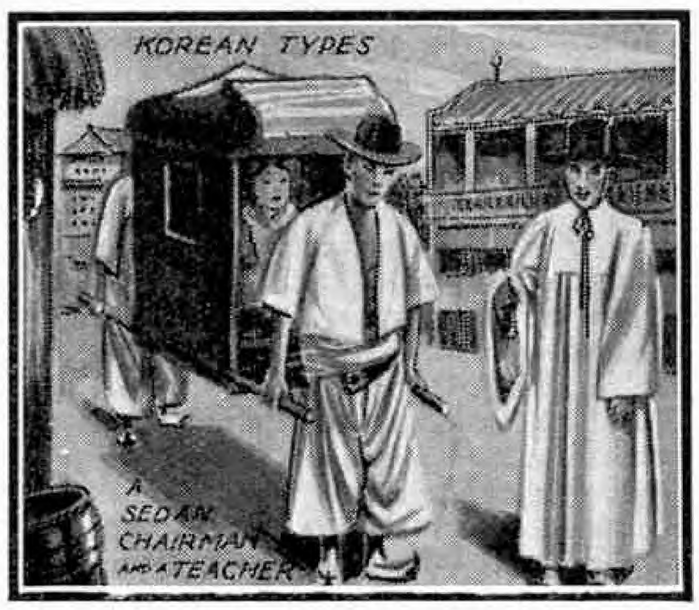
Big Game Fish in the North Sea

One of the most surprising developments in recent years has been the invasion of the North Sea by the tunny. Many giant specimens of this fish caught by rod and line were landed at Scarborough, Whitby and other places on the Yorkshire coast during last summer and early autumn, the largest weighing 851 lbs. This is much less than the weight of the full-grown tunny of more genial southern waters, however, for in warmer seas the fish can attain a length of 10 ft. and a weight of 1,500 lb.

The tunny is the largest of the mackerel family and is found in all warm seas, where it preys on other fish. It seems to have made its first appearance in the North Sea as long ago as 1911, a year that was notable for its warm, dry summer, and for the increase in the amount of plankton, or microscopic animal life, in the warm waters. Small fish feed on plankton, and no doubt flourished in 1911, with the result that the tunny was attracted by the plentiful food they afforded. It is only in recent years that it has appeared in such numbers as to afford sport for anglers, and the record catches made in the North Sea during last summer may have been a consequence of the hot weather then prevailing.

Spider's Huge Appetite

If a man could eat as much in proportion to his weight as a spider, his daily food requirements would include four bullocks, 13 sheep, four hogs and a few barrels of fresh fish. This revelation of the spider's gargantuan appetite has resulted from experiments in which one of these creatures was weighed and then supplied with insects of known weight until it was satisfied.

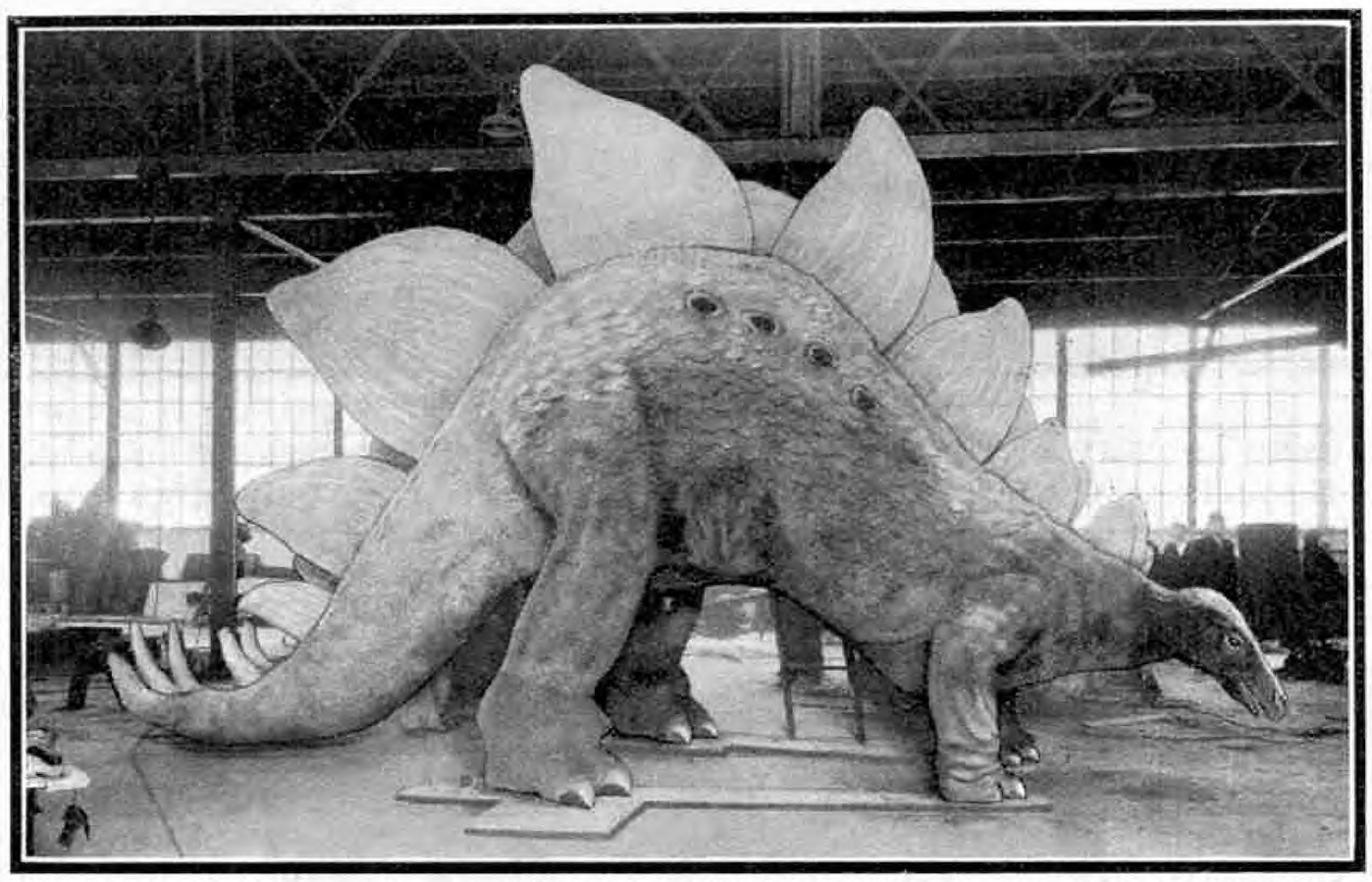


Winking Dinosaurs at Chicago

Visitors to the "Century of Progress" Exhibition recently concluded at Chicago were surprised to find giant dinosaurs of 80,000,000 years ago that had apparently come to life! Faithful models of the tyrannosaurus, stegosaurus, triceratops and other prehistoric creatures stood on a rock 45 ft. in height, and blinked their eyes, nodded, wagged their tails and gave vent to blood-curdling noises; while in a lake at the base of the rock was a duck-billed dinosaur that churned the water with its tail in an astonishingly realistic manner.

The models formed part of an exhibit arranged by the Sinclair Refining Company to illustrate the conditions prevailing when the world's stores of oil were formed. The largest was a brontosaurus, 70 ft. in length and 22 ft. in height. Coloured electric light bulbs represented its eyes, and these winked continuously, for a small electric motor caused the creature's eyelids to open and close. Other motors moved its head, neck and mouth, and tail, and a special motor was installed to actuate portions of its chest that were made of leather, thus enabling the act of breathing to be simulated.

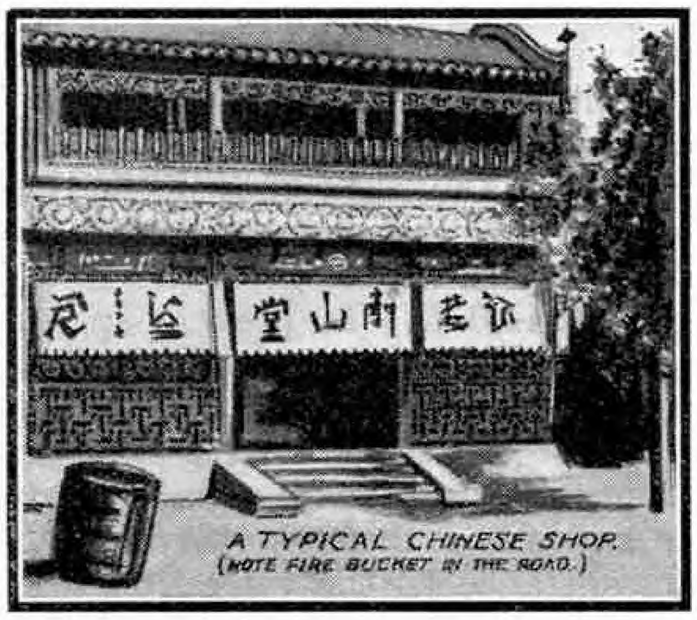
Each model was built up round a steel skeleton with welded joints. Wire netting was placed over this framework in order to give the correct shape, and this was covered with a composition sprayed to resemble hide.



A life-like model of a stegosaurus, a prehistoric creature 30 ft. in length that was remarkable for the gigantic bony plates on its back. The model incorporated three small motors that actuated its head, tail and limbs. Photograph by courtesy of the General Electric Company of New York.

Largest Moon in the Solar System

Six of the Sun's nine planets are accompanied in their journeys through space by moons, Jupiter and Saturn having nine each, Uranus four, Mars two, and the Earth and Neptune one each. The heaviest of the 26 moons within the solar system is that of Neptune, which circles round that planet in a few hours less than 66 days. The gravitational pull of the smaller body is sufficient to cause the planet alternately to run slightly ahead of the position it would occupy if it had no moon, and to fall a little behind. This has enabled astronomers to calculate the weight of this remote satellite, which is more than five times as heavy as our Moon, and is more massive than Mercury and Plato, the planets nearest the Sun and farthest away from it respectively.



Bottled Light

A novel safelight is now employed by watchmen in French magazines in which explosives and inflammable materials are kept. It is made by placing a small piece of phosphorus in a small phial of clear colourless glass and adding warm olive oil until the vessel is about one third full, when it is tightly corked.

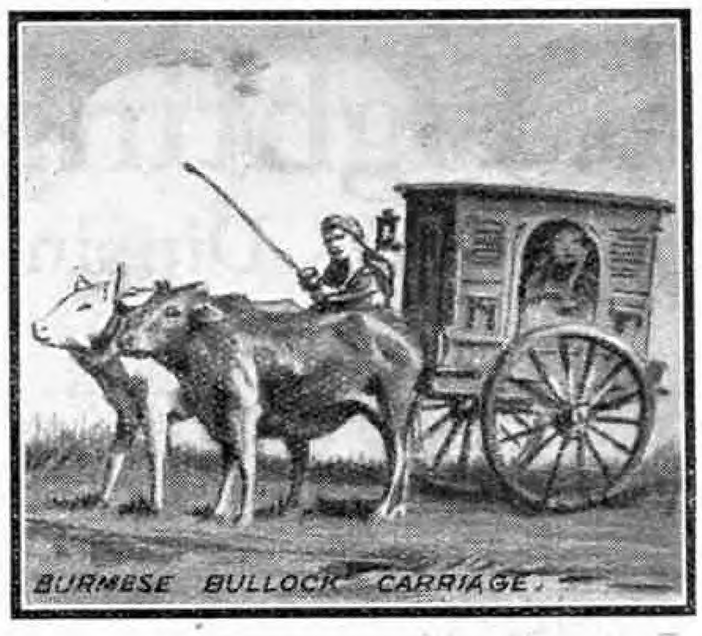
When one of these lamps is required for use, the cork is removed in order to allow air to enter, and the phial is then closed. The empty space then becomes luminous, and gives sufficient light to enable a watchman to carry out his duties. The light slowly becomes dim, but can always be renewed by simply taking out the cork in order to admit a new supply of air.

The glow is caused by the slow burning of phosphorus vapour, derived from the solution in the olive oil, and this explains why air must be admitted from time to time in order to renew the illumination. No refills are necessary until the lamp has been in use for about six months. It works satisfactorily in cold weather if the phial is warmed by holding it in the hands for a short time.

A Rival to Wheat

For countless ages wheat has been one of the staple foods of mankind, but a possible rival to it has now been discovered in Queensland. This is Mitchell grass, which resembles wheat in appearance, but has a smaller kernel. Experiments in selecting and breeding new types of the grass are now being made. It is expected that forms with larger kernels will be discovered, and if by this means the grass is made more productive, it may become a valuable source of food.

Mitchell grass has the great advantage over wheat that it is perennial, and therefore does not need sowing annually. In addition it roots more deeply, and therefore would be less affected by drought. It could be grown in many areas that are unsuitable for wheat, and its introduction would add to the available quantity of staple foodstuffs. Australian aborigines are reputed to grind its kernels for food, and its value seems to be proved by the fact that stock feeding in districts in which it grows have a reputation for stamina and hardiness.



Ghost Trains in Northern Europe

Readers who saw the famous film "*The Ghost Train*," the making of which was fully explained in the "*M.M.*" for December, 1931, will be interested to learn of the reported appearance of a ghost train in Sweden. People walking near the section of track on which it runs have described it as a lighted train, with unusually powerful head and tail lamps, that glides along at high speed and without noise. It has usually been seen about half an hour before the ordinary night train is due. So far no satisfactory explanation of the apparition has been found. It has been suggested that it is a form of mirage, and the absence of sound makes this a probable explanation. Old people living in the district regard the appearance of the mysterious train as a warning of a coming disaster, however, and it is noteworthy that a few years ago the ground gave way beneath the section of railway concerned.

A similar ghost train is said to have been seen rushing through a forest in a desolate part of Lapland a few years ago.

Threat to World's Largest Rodent

The capybar is the largest and in many respects the most interesting of living rodents, or gnawing animals, an order to which beavers, rabbits, squirrels, rats and mice belong. It belongs to the same family as the guinea pig, and is found in South America. When fully grown it may weigh as much as about 100 lb. Its length is about 4 ft., but fossil remains of capybars 5 ft. in length have been discovered in South America, and the modern creature therefore is less than its prehistoric ancestors.

The capybar has scanty reddish brown fur and its feet are webbed. It makes its home among the reeds and other water plants on the margins of streams and lakes, and in the past it has had two great enemies, the jaguar, and the anaconda, a giant aquatic snake, attaining 30 ft. in length. Man now shows signs of becoming its third enemy, for the skin of the capybar has been found to make excellent saddlery, and if the creature is hunted as thoroughly as other wild creatures that yield valuable furs and skins, it will probably become extinct.

Fighting Tick-Borne Disease

Dipping Cattle on a Rhodesian Ranch

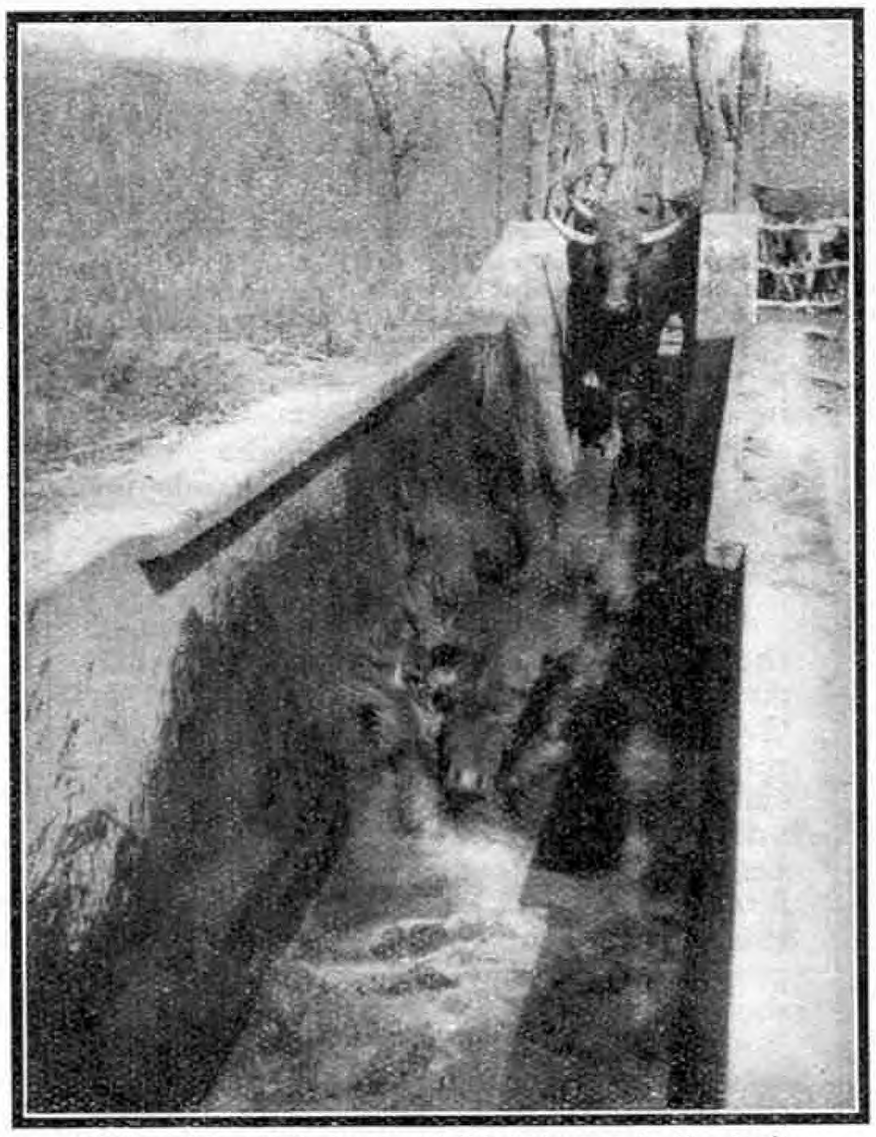
By Wilfrid Robertson

TO most people arsenic is a poison with a use confined almost solely to the clumsy criminal of modern detective fiction; the part that it plays in many an industry to-day is seldom realized. Yet there are many agricultural, pastoral, and manufacturing concerns that would be forced to cease their activities if the supply from the world's arsenic mines were to fail. Especially is this true of the cattle-raising industry of Rhodesia and the adjacent countries throughout Central Africa, for arsenic has proved itself the only weapon with which the rancher can combat the spread of scourges such as African coast fever, gall-sickness, red-water, and other deadly diseases.



Natives rounding up a herd for the weekly dipping.

When the plateaux of Rhodesia were first occupied by the white man, it was seen that they had the makings of a good cattle country. The native stock, though small, were fat and healthy, and free from disease. Land was taken up by settlers in large blocks for ranching, but with increased stocking and the importation of European types of cattle—beasts not rendered immune to the local maladies by generations of life in the country—fatal diseases began to devastate the growing herds. Scientific investigation trailed the source of infection, and it was found that the germs were transmitted from sick beasts to healthy ones by the activities of the different kinds of blood-sucking grass-tick. To destroy the tick and prevent it from breeding was also to destroy the risk of infection.



Cattle taking the plunge at the entrance to the tank.

The typical life-history of a female tick can briefly be described as follows. The parasite, about the size of a split lentil, transfers itself from a grass-blade to the body of a feeding bullock. Working its way into the animal's coat, the tick buries its head in the thick skin and begins its vampire-like feed, meanwhile infecting the beast with the germs of whatever disease it happens to be the carrier. Ten days or a fortnight later the blood-sucker has swelled until it resembles a grape in size and appearance. Presently the gorged parasite drops off into the grass once more, there to lay its mass of eggs and breed a further supply of similar pests.

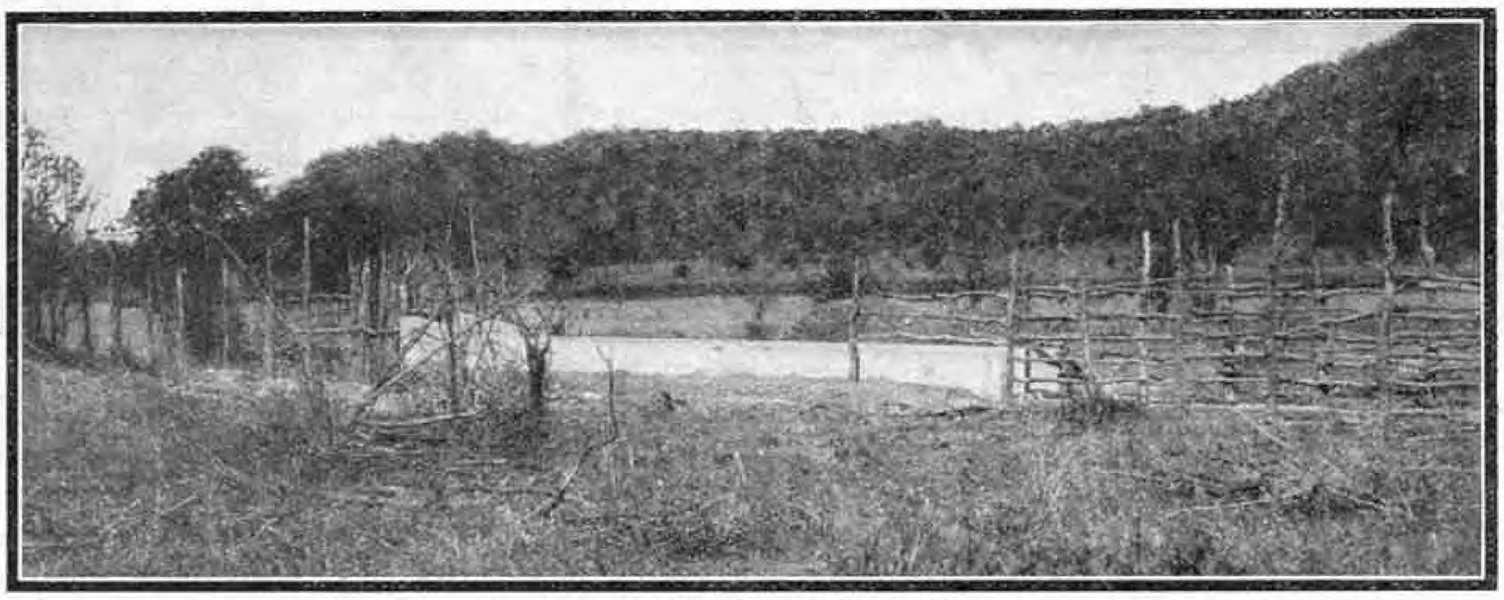
To prevent tick-borne disease the rancher strikes direct at the carriers that fasten themselves to his cattle—he immerses the herds once a week in an arsenical solution. Not only does this kill the parasites and prevent them from propagating, but in time the animals' hides become so impregnated with arsenic that any stray tick that fastens itself thereto will be poisoned almost as soon as it thrusts its jaws through the skin.

To dip weekly many thousands of cattle on a ranch would appear at first sight to be a colossal task, yet this is not so, owing to the regularity with which it is practised and the consequent knowledge and comprehension of the animals concerned. On my ranch in Rhodesia I found that, without undue haste, cattle could be worked through a dipping-tank at the average rate of 500 or 600 an hour.

Dipping tanks are usually made of reinforced concrete, though sometimes brick with a facing of cement is used. Both for convenience and strength the main vat is built below ground, the natural soil around it buttressing the walls against pressure from within. The bath that holds the solution of arsenic is about 25 ft. long by 4 ft. wide at the water-level, and the depth of the liquid is 6 ft. To prevent splash and loss of solution, the concrete sides are carried up to about 4 ft. above the level of the liquid. At the point where the cattle enter, the drop is sheer, forcing them to plunge and be totally immersed; at the other end, which the beasts reach after swimming through, there is an inclined plane. At the entrance to the tank from the

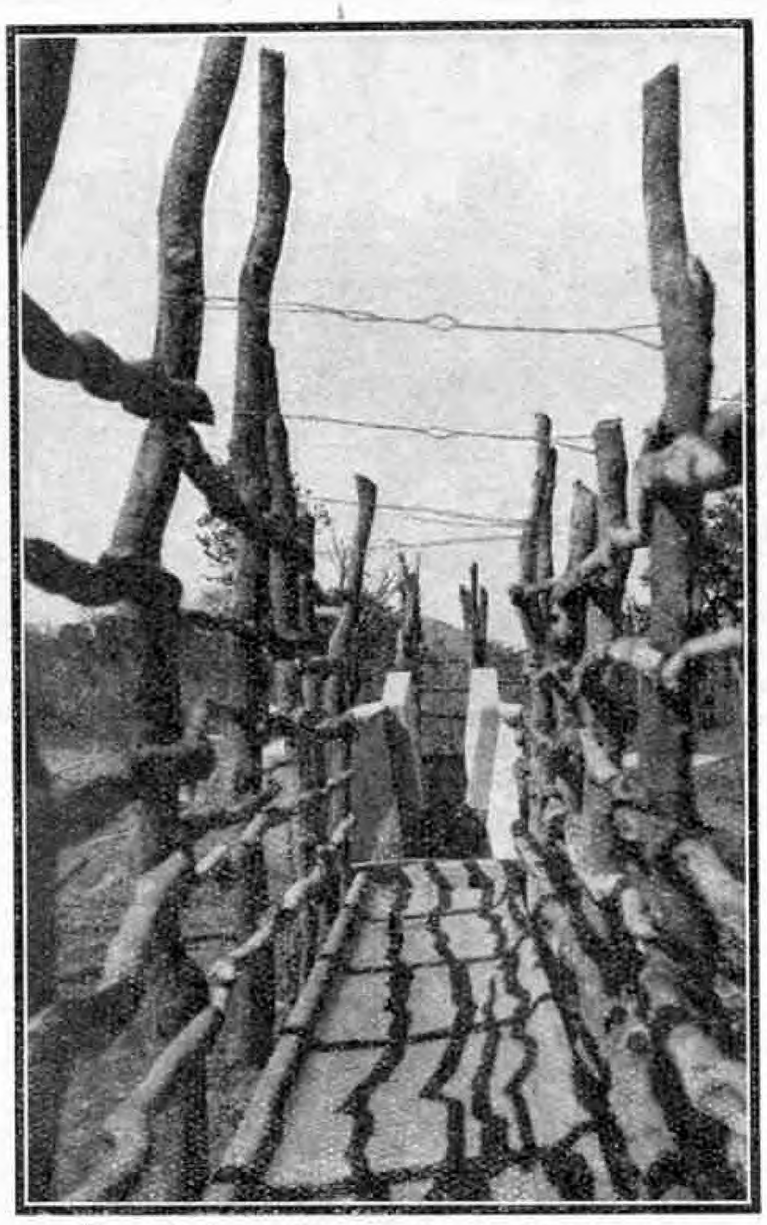
collecting enclosure V-shaped retaining-walls of concrete form a "crush" or narrow passage along which the animals advance; at the other end a dripping-race and draining-pen of cement catch the surplus liquid falling from the cattle and let it drain back into the tank.

A large ranch possesses several tanks. On the evening before the dipping-day of a particular area, the herds are rounded up by the natives in charge, and with the rising of the Sun they are driven towards the tank where the owner awaits their arrival. By eight o'clock a pillar of dust rising above the trees of the "bush" announces the advance of the first mob to reach the spot. To the shouts and whip-cracking of the natives the beasts are driven into the stout enclosure of poles that forms the collecting-pen, and the bars across the passage leading to the tank itself are pulled aside.



General view of a dipping tank.

"Dip! dip! dip!" Out rings the English word of which both natives and cattle have learned the meaning. With the passivity of long custom the beasts nearest the entrance-race turn into it. Splash! The first animal leaps into the tank, the solution sousing well over its head and ears as the weight of the plunge sends its feet down to the bottom. Up it rises, sending a rolling wave along the chocolate-coloured surface, and strikes out for the further end of the tank. Splash! Another beast follows, and swims across in the wake of the leader. Rapidly the collecting-pen empties itself, while the streaming cattle increase in numbers in the draining-pen. The efforts of the natives are confined mainly to preventing the cattle from entering the tank too rapidly, and in consequence jumping on each other's backs; while the white owner stands, "ticker" in hand, counting the herd as it passes through. One hundred, two hundred, three hundred, four hundred—the owner glances at the paper he has pulled from his pocket to check the figure and to make su that no beasts are missing. They are all there. The herd is driven off, and its place is taken by the next mob to arrive at the rendezvous.



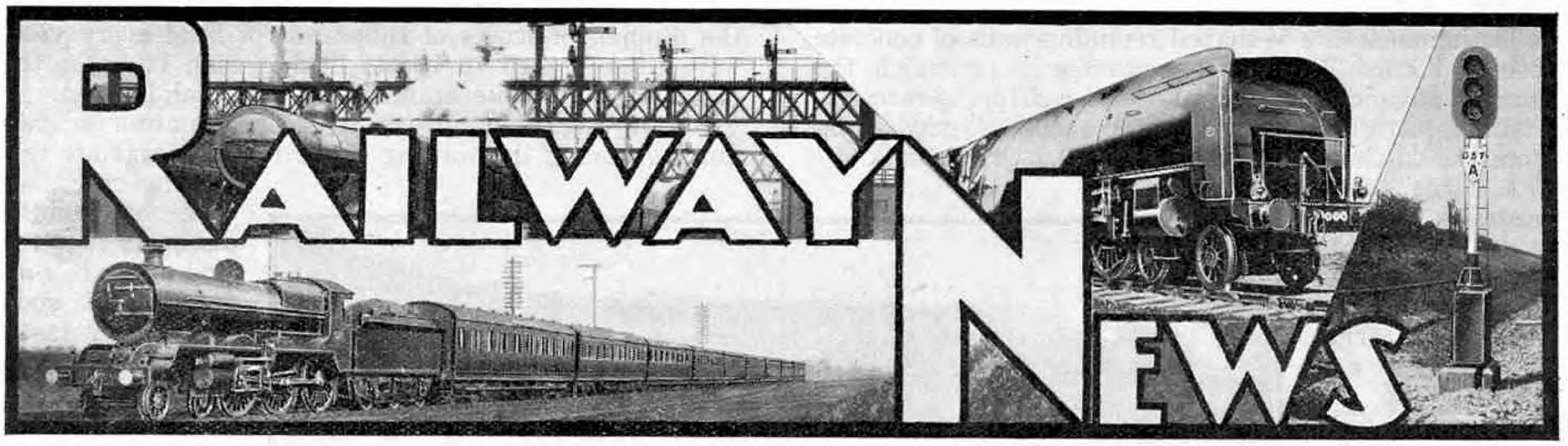
The exit from the tank and the draining pen.

Considering that the solution into which the cattle plunge and swim is deadly poison, it may be wondered how the animals escape swallowing some of the fluid and suffering from its effects. The reason is that a beast, when it jumps, instinctively closes tightly its mouth and nostrils—did you know that an animal of the bovine species can shut its nostrils as firmly as its mouth? The only poisoning cases I remember, during the dipping of scores of thousands of head every year, were those traced to beasts licking each other or the damp ground while standing in the draining-pen. I found it advisable always to keep a native or two moving among the waiting cattle to guard against this contingency, for once an animal discovers that the solution of arsenite of soda has a salty taste, it will lick the drippings assiduously, and attract others to do the same. To act as a deterrent against this taste, many ranchers add a quantity of bitter aloes to the fluid in the tank; and several of the concentrated proprietary dipping fluids that are sold contain a proportion of this evil-tasting product.

Rhodesian cattle are dipped almost from birth. At the heels of its dam a six-days-old calf comes down the entrance-race and tumbles into the liquid. It goes under and rises, gasping with surprise, and immediately strikes out with the energy of a Channel-swimmer in the wake of its mother. It is strange that, of all the animals, only developed and civilized man has to be taught to swim; young cattle, young deer, and tiny children of savage peoples like the South Sea Islanders, master the art of keeping their heads above the surface as soon as they find themselves in water.

As a general rule, accidents to cattle during the process of dipping are rare occurrences, and those that happen are usually due to a sudden rush of beasts eager to plunge into the cool liquid that they know will rid them of irritating parasites. Despite the narrowness of the entrance-race, at times animals will surge forward in a solid pack, and often it is almost impossible to prevent one of them from jumping so that its feet hit the back of the one before it. If both are beasts of the same size, little harm is done; but if a small calf happens to be undermost, the descent of a large animal upon it may result in a damaged or broken spine.

And now as to the effect of the poison on the ticks themselves. The blood-suckers do not part company with their hosts in the tank itself, they die and drop off during the ensuing 24 hours. Each dipping of the cattle on a ranch destroys many thousands of potential carriers of disease and their offspring, and the weekly slaughter of parasites over any large district must run into vast figures. Yet, despite the relentless war against them, the races of ticks manage grimly to survive, ready to increase to their former numbers if ever they are given the slightest chance to do so.



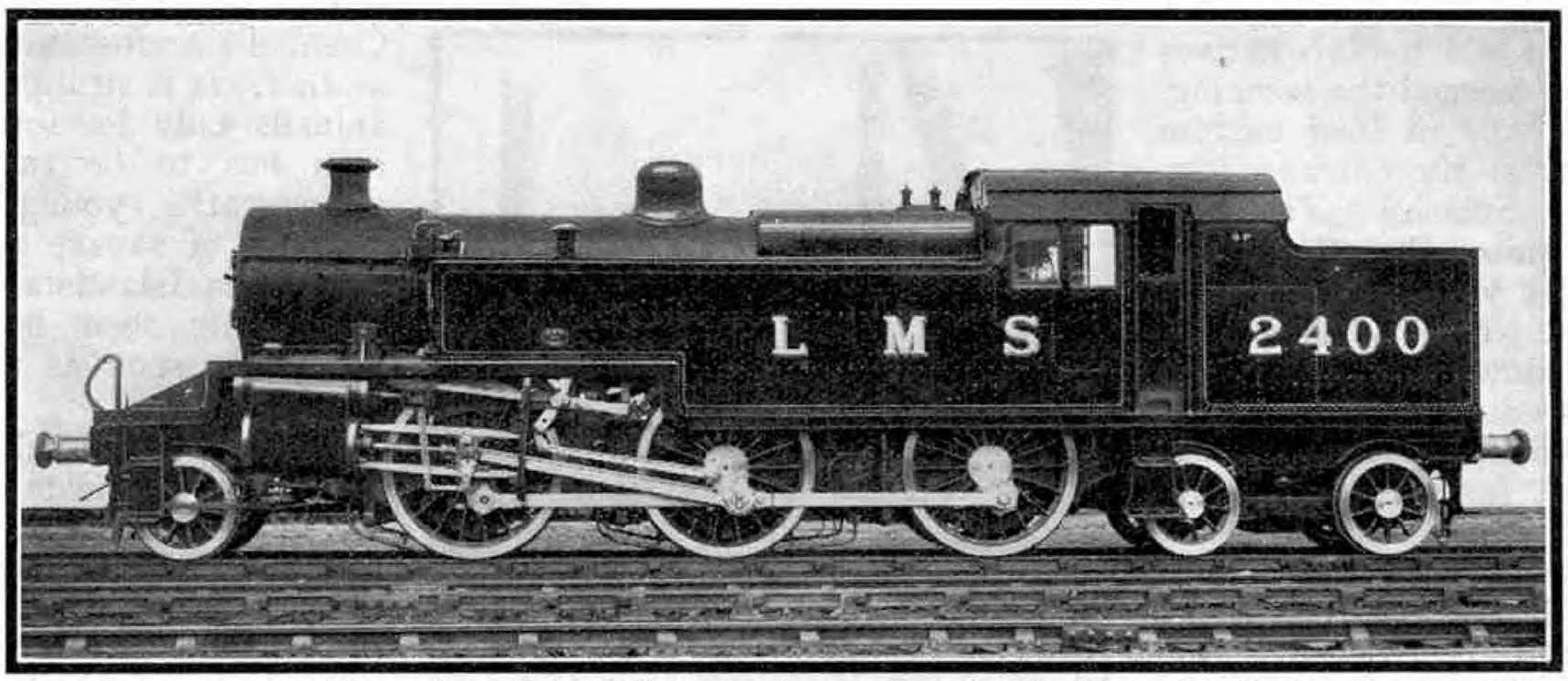
"Limousine" Cabs on L.M.S.R. Locomotives

Of the new batch of 30 standard 2–6–4 tank engines on which Derby works have been engaged for several months past, 20—Nos. 2395 to 2414—are now out and at work. A new and prominent feature has been introduced in these engines as compared with the earlier ones of the class in that the driver's cab is totally enclosed, being fitted with an all-over roof, large glass side-windows, two on each side, and doors, one on each side, with windows that can be dropped and raised like those usually fitted to the doors of carriages. As these engines are intended primarily for fast suburban services, and can run either forward or in reverse with equal speed and facilitv. these "limousine" cabs will afford the maximum protection from the weather for the men on the footplate.

The third "Pacific" locomotive, No. 6202, on which work is proceeding at Crewe, will be markedly different from the first two that are already in service. In place of the usual cylinders with their drive through pistons and connecting rods, a new and simplified form of turbine drive will be fitted. The first "Pacific," No. 6200, "*The Princess Royal,*" while waiting for its companion No. 6201 to come and jointly share the daily working of the "*Royal Scot*" expresses between London and Glasgow in both directions, has been employed on a variety of services. For some weeks it was located at Carlisle shed, and each week-day worked the up "*Royal Scot*" on its non-stop run of almost 300 miles from Carlisle to Euston, and returned each night on the 11 p.m. Scottish express from Euston. This was an exacting booking, and entailed a mileage of 3,600 a week.

Among the recent withdrawals for scrapping have been two interesting engines of the former L.N.W.R. The first of these was No. 5554, "*Prospero,*" a 4–6–0 engine of the "Experiment" class, which in 1915 was rebuilt with four cylinders in place of the original two, and the Dendy-Marshall patent valve-gear. The other engine was No. 5632, "*Bret Harte,*" a 4–6–0 of the "Prince of Wales" class, which some years ago was experimentally fitted with outside valve motion for its two cylinders, which were inside. This, it should be noted, is the first locomotive of the "Prince of Wales" class to be sent to the scrap heap.

A brilliant bit of speeding was accomplished recently by the rebuilt four-cylinder "Claughton" No. 5927, "*Sir Francis Dent,*" driven by Driver L. A. Earl, when working the 4.50 p.m. express from Birmingham to London. The train was stopped by signal at Tring Cutting box with the result that, after starting again, Tring Station was passed 3½ min. late. Yet in spite of this delay Willesden was reached 45 sec. early, the run of 28.6 miles from Tring Cutting box to Willesden having been done in 25 min. 10 sec., start to stop, or at an average of 68.7 m.p.h. A speed of 90 m.p.h. was attained at Kings Langley and of 91 m.p.h. at Wembley.



L.M.S.R. locomotive No. 2400, one of the standard 2-6-4 tanks that are provided with side-window cabs. The door also has a window which can be let down, thus providing more comfortable conditions for the enginemen. Photo courtesy L.M.S.R.

New 2-8-2 Express Locomotive for the L.N.E.R.

A very powerful express locomotive having the 2–8–2 wheel arrangement is under construction at the L.N.E.R. works at Doncaster. Details have not yet been published, but enough is known to arouse keen interest in what will be a unique type of express locomotive for Great Britain. Poppet valves will be used and it is understood that the design has been influenced by the remarkably successful performances of some of the modern French eight-coupled locomotives. Five of these engines are to be built for express working between Edinburgh and Aberdeen.

L.N.E.R. Locomotive News

The series of 3-cylinder 4–4–0 express locomotives of the "Hunt" class has now been completed at Darlington, the last two to be sent into service being No. 297, "*The Cottesmore,*" and No. 298, "*The Pytchley.*"

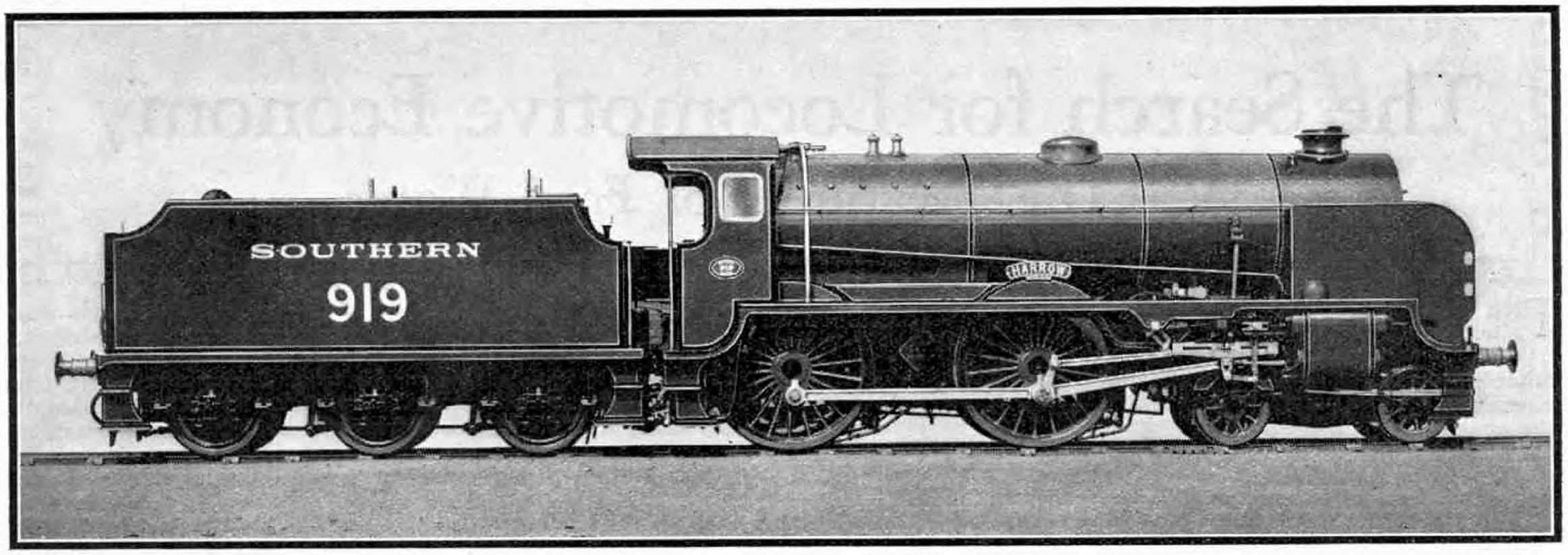
A cheering indication of improving trade is the fact that 36 L.N.E.R. locomotives that had been tallowed down for several months have been returned to service. These locomotives, together with several others, were cleaned, covered with tallow, and placed in various sheds to be preserved in good order until required, and the demand for more locomotives has now caused them to be returned to active service.

The "Pacific" locomotives of the L.N.E.R. have now run a total distance of over 34 million miles! The first Gresley "Pacific" was built in 1922, and the full fleet now consists of 75 engines, eight of which have hauled passenger trains for more than 600,000 miles, as follows:—No. 4476, "*Royal Lancer,*" 655,239; No. 2568, "*Sceptre,*" 647,725; No. 2569, "*Gladiateur,*" 633,446; No. 4475, "*Flying Fox,*" 627,310; No. 2570, "*Tranquil,*" 619,655; No. 4474, "*Victor Wild,*" 616,867; No. 2564, "*Knight of the Thistle,*" 609,304; No. 2572, "*St. Gatien,*" 608,478.

The famous "Flying Scotsman" locomotive, No. 4472, has travelled 567,614 miles, although during the summers of 1924 and 1925 it was standing idle at Wembley Exhibition. These splendid engines do increasingly good work and keep booked time with trains that considerably exceed 600 tons in weight.

Long Run of L.M.S.R. Newspaper Express

A non-stop run of 233 miles from Euston to Morecambe is made by a new train that the L.M.S.R. have introduced for the conveyance of newspapers on Saturday nights to Morecambe, Heysham and Northern Ireland. No passengers are carried by this "flier," which makes the journey at an average speed of 56 m.p.h.



A Triple Expansion Locomotive

Among the foremost of the world's railway companies to experiment with high steam pressures has been the Delaware and Hudson in the United States of America. Since 1924 four special experimental locomotives have been built, each of which has marked some distinct advance. The latest of them formed one of the most remarkable exhibits at the "*Century of Progress*" Exhibition at Chicago during the past summer, as mentioned on page 738 of the "*M.M.*" for October. It is numbered 1403 and named "*L. F. Loree.*" While its three predecessors have been 2–8–0 compounds, this latest engine is a triple-expansion 4–8–0, and is, indeed, the only triple-expansion steam locomotive in the world. It has four cylinders, one high-pressure, one intermediate pressure, and two low-pressure, all of which are outside and drive on to the second coupled axle and have a stroke of 32 in. The high-pressure and intermediate-pressure cylinders are placed at the rear of the engine under the cab at the left side and right side respectively, the diameter of the high-pressure being 20 in. and that of the intermediate 27½ in. The two low-pressure cylinders occupy the usual position under the smoke-box, and are 33 in. in diameter. Poppet valves operated by rotary cams are fitted. The eight coupled wheels have a diameter of 5 ft. 3 in.

The huge boiler is of a special water-tube type and has a total heating surface of 4,427 sq. ft. The area of its grate is 75.8 sq. ft. and it has a working pressure of 500 lb. per sq. in.

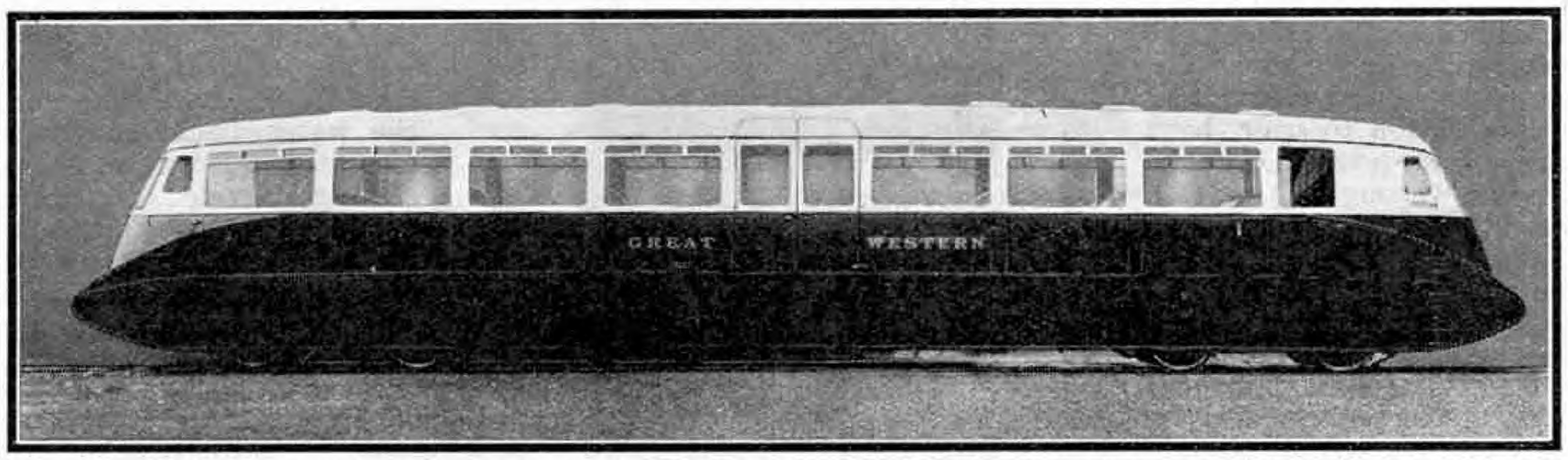
The weight of the engine in working order is 170 tons 10 cwt., nearly 140 tons being carried by the coupled wheels. The tender, which is mounted on two bogies, one having four wheels and the other six, weighs in full working order 122 tons 4 cwt., making a total for the engine and tender of 292 tons 14 cwt. It is expected that this unique engine will show a very high efficiency in service.

S.R. Locomotive News

The latest 2–6–0 engines of the "N" class are fitted with side-sheet smoke deflectors similar to those on the modern express engines of this Company.

The new locomotive depôt at Hither Green has been brought into use. It has all the latest and best equipment and is capable of dealing with 18 locomotives. Together with the new sorting sidings it has cost £100,000.

The last of the 0–4–2 express locomotives of the "Gladstone" class, No. 172, has ceased from service and been taken to Brighton works for scrapping. No. 172 was built at Brighton for the former L.B.S.C.R. to the design of Mr. William Stroudley, in 1891, and then received the name "*Littlehampton.*" Happily, "*Gladstone,*" the first engine of this famous class, is preserved in the Railway Museum at York.



The upper illustration, reproduced by courtesy of the S.R., shows No. 919 "Harrow" of the famous "Schools" class fitted with smoke deflectors. In the lower illustration there appears the special streamlined rail car recently introduced on the G.W.R., to whom we are indebted for the photograph.

Streamlined Rail Car for the G.W.R.

The streamlined rail car illustrated on this page has been introduced by the G.W.R. on its services between Reading and Slough. It is of unique design, and is the outcome of exhaustive tests to reduce wind resistance, which at speed requires more power to overcome than is needed to drive a car along. In appearance it resembles a huge seaplane float, with observation windows running along the top part, and merging at each end into sloping control cabins.

The car is 62 ft. long, and 11 ft. 4 in. high. It weighs 20 tons, and has been designed for a maximum speed of 60 m.p.h. It has a seating capacity for 69 passengers. The car is driven by a 130 h.p. heavy oil engine, almost identical with the engines fitted in some of the London buses.

Watching the Water in Engine's Tender

Scientific research has produced many heroes, the latest being an anonymous L.M.S.R. expert whose job has been to ride about in the water tank of an engine tender, watching the water rush into the tanks from track-troughs over which the locomotive was passing at speeds of up to 80 m.p.h.

This novel job, for which a special compartment fitted with gauges was built into the locomotive water tank to accommodate the observer, is likely to yield a huge economy in water, for the research has disclosed that with the ordinary type of scoop there is a big wastage of water thrown clear of the troughs by the pick-up gear of the engine. Engineers have now designed a special type of deflector which, when ploughing through the water in advance of the scoop, forces a greater quantity of water into the centre of the tanks and minimises overflow from the troughs. It is estimated that the fitting of this deflector to all L.M.S.R. locomotives equipped with water pick-up gear would yield an economy of 20 per cent. in the amount of water used in the track-troughs.

New "Castle" Locomotives for the G.W.R.

After several months during which nothing but small tank engines have been built, the works at Swindon are now busy with an order for a further batch of 10 express engines of the "Castle" class. Following on the necessary preliminary preparations in the machine and fitting shops, the frames are just about to be laid down in the erecting shop, and the actual work of construction will then proceed.

Many "Kings" and "Castles" are visiting the works for thorough overhaul after the long and busy holiday season.

It is satisfactory to report that Swindon is feeling the benefit of the general improvement in trade and quite a number of men who had been "stood off" through shortage of work have recently been restarted.

The Search for Locomotive Economy

V.—The Treatment of Feed Water

THE steam locomotive obtains its power from the combined action of those age-old enemies fire and water. The boiling of a quantity of water to produce steam by means of a suitable fire appears simple enough, and to many the evaporative processes in a locomotive boiler involve nothing more. During the course of its non-stop run from Paddington to Plymouth the "King" class locomotive in charge of the "*Cornish Riviera Express*" uses some 8,000 gallons of water, or nearly 36 tons, but such a locomotive giant as a Canadian National 4–8–4 of the "6100" class would evaporate about 14,000 gallons on an average run of 185 miles in length.

The evaporation day after day of large quantities of water drawn from different sources soon has its effect on the interior of the locomotive boiler. Everybody is familiar with the fur that forms on the inside of a domestic kettle, particularly when the water used happens to be of the kind known as "hard" water. The locomotive boiler is much more liable than a kettle to become furred because of its constant use of large quantities of water of varying quality. Unfortunately, as those connected with the Locomotive Departments of our railways know, the water used is frequently not as good as is desirable, and the formation of scale to a more or less extent is the result of its use. This scale is hardened fur, and is deposited on the internal surfaces of the boiler. By settling on the fire-box plates and the tubes, it impedes the transference of heat to them through the water, and leads to waste of fuel. It is also a potential source of danger in that it and the boiler plates have different rates of expansion and contraction. This causes leakage of tubes and plates, and failure of stays. In addition to scale, hard waters cause foaming and priming, or the carrying over of water through the steam pipes into the cylinders, where its presence is undesirable and possibly dangerous.

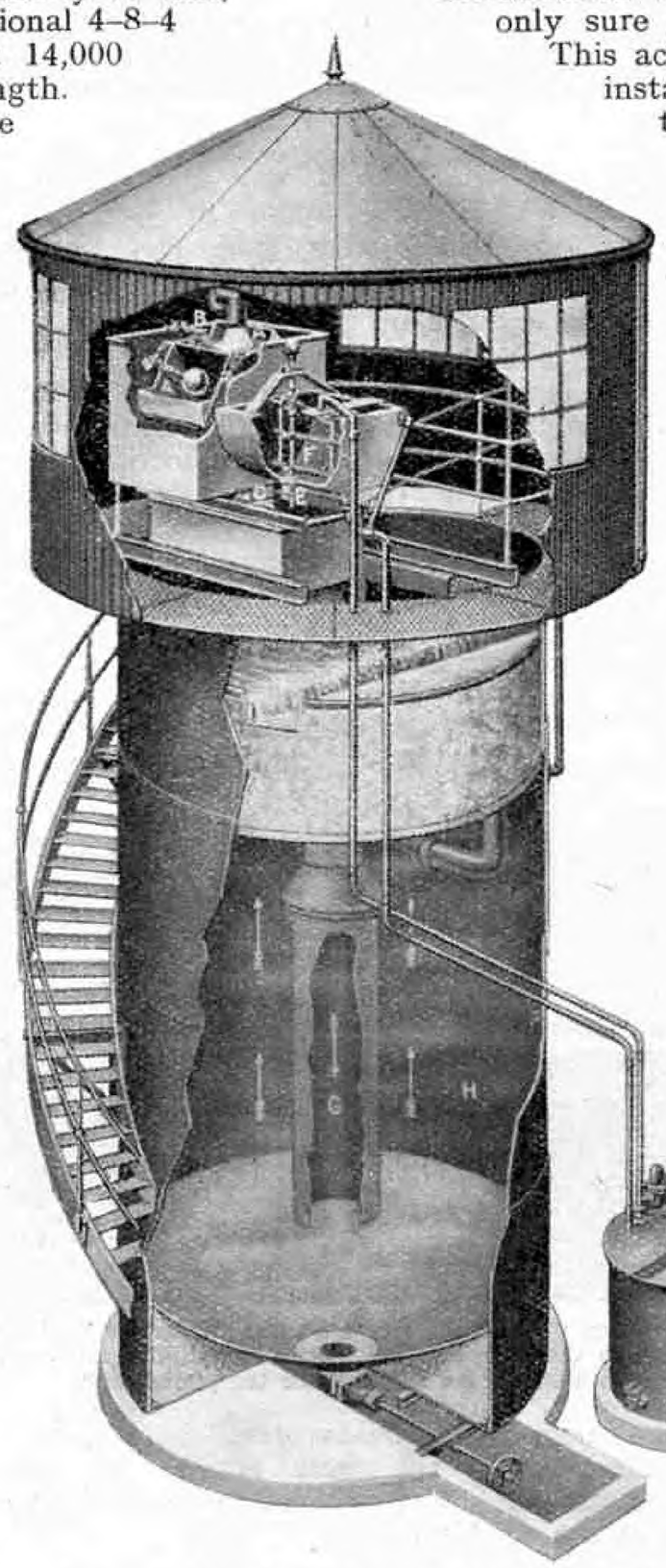
The boiler is the most costly part of the modern locomotive. It is important, therefore, that it should be kept in an efficient condition by those upon whom its examination and maintenance devolve. Were it not for the removal of scale by the periodical opening up and washing out of the boiler the efficiency of the latter would be seriously impaired, and the fuel consumption necessary for the evaporation of a given quantity of water would be greatly increased.

Practically the greater part of one day in every seven of a steam locomotive's existence is spent standing at the depot receiving attention from the shed staff. True, some of this consists of necessary repair work of varying duration, but a large proportion of the time is set aside for boiler washing. Various systems of high-pressure washing are in use, but many sheds still employ the more elementary methods, and there the thoroughness of the work depends largely on the washers themselves. It will be realised, therefore, that the reduction of this scale-forming tendency in the water used would increase the efficiency of the engine, and would make for economy by reducing the amount of boiler-washing required.

Another trouble due to impure water is corrosion inside the boiler. Fortunately the corrosive action of water in this country is not very marked, but it has to be allowed for. In other countries it is more serious. It is reported that in certain cases on the Trans-Australian railway, metal $\frac{1}{2}$ in. in thickness was eaten through in a few years. A cast iron steam pipe developed a hole through its thickness of 9/16 in., and a tube plate $\frac{3}{4}$ in. in thickness had to be discarded after half its expected normal life of 14 years had been completed. The trouble was chiefly due to the use of water heavily impregnated with salt, sulphate of lime or "gypsum," and other minerals.

The "water trouble" is as old as the locomotive itself, but not until comparatively recent times have systematic attempts been made to tackle the question. It is now generally realised that the correct scientific treatment of the water before its introduction to the tender or tank of the locomotive is the only sure method of dealing successfully with the evil. This accounts for the evolution of the water-softening installations which have been applied here and there in bad water districts in this country for quite a long period. In America water softening has been a general practice for many years. The biggest and most systematic installation ever undertaken in Europe is that recently completed on the L.M.S.R. On the Western and Midland main lines between London and Carlisle no less than 28 places are equipped with softening plants, so that the purity of the water supplies for engines on those routes is ensured. This step should contribute much to the reduction of the costs of boiler maintenance on that railway. It has been computed that the average loss to a railway company amounts to 6d. for every pound of ordinary mixed scale deposited in the boilers of their locomotives by scale-forming water.

The characteristics of water drawn from different districts vary according to the geological nature of the soil. In Scotland the water is remarkably pure, and boiler washing is thus required far less frequently than in England, where in a chalky district the water would contain a certain amount of lime in suspension. Natural water holds carbon dioxide in solution, and when it comes in contact with magnesium and limestone rocks, some of the latter are dissolved, resulting in the presence of magnesium and lime salts in the water. When this water is boiled the carbon dioxide is driven off, and these salts are precipitated in the vessel in which the evaporation is carried out, thus forming fur and eventually scale. This hardness, removable by boiling, is known as temporary hardness. It is clear, however, that its removal before its use in the boiler will be of considerable advantage, as the formation of scale will be largely eliminated if the water is "softened," as it is termed, before evaporation. This softening is performed by the addition of suitable amounts of lime. The lime combines with the carbon dioxide that is in solution, and the insoluble lime and magnesium salts are precipitated.



Sectional view of a water softening plant. This operates on the L.H. Continuous-Automatic system that is described in this article.

What is known as "permanent" hardness, or that not removable by boiling, is due to the presence of sulphate of lime in the water. This hardness may be removed by the addition of carbonate of soda or "soda ash" to the water. The sulphate is decomposed and calcium carbonate precipitated.

In order to remove both the temporary and permanent hardness from water intended for locomotive purposes lime and soda ash are introduced to it in definite measured quantities according to the degree of hardness of the water. It is of course desirable that the softening plants should be continuous in operation, and should work with the minimum of attention, though it may be mentioned that a plant of the non-continuous variety, erected at Derby over 40 years ago, is still operating successfully.

In the early non-continuous type of plant there were usually four or five tanks charged with water to which the requisite amounts of lime and soda ash were added. After allowing suitable time for the settling of the precipitate and clarification of the water the softened water was drawn off from the top. The essential features of a modern continuous plant consist of the mechanism to proportion and supply the correct amount of chemicals to the water; a tank in which the precipitation and settling-out takes place, and filters to complete the clarification of the softened water.

The great advantage of the continuous type of plant now in vogue as a result of various improvements in design, is that large quantities of water can be softened in a single tank. The Colne Valley plant on the L.M.S.R. is capable of dealing with no less than 50,000 gallons hourly, and is the largest on the system. This is one of the number installed by United Water Softeners Ltd., who were also responsible for the plant at Castlethorpe troughs, which we illustrate on this page. Incidentally, the water-softening plant at Hessle, in Yorkshire, the largest on the L.N.E.R., is also operated on the system perfected by this firm. This is termed the "L.H. Continuous-Automatic" process and the stages in the softening can readily be followed by reference to the sectional view of a softening plant on the previous page.



The softening plant and water troughs at Castlethorpe on the L.M.S.R. The plant operates on the L.H. Continuous-Automatic system perfected by the United Water Softeners Ltd., to whom we are indebted for this and the illustration on the previous page, and for information incorporated in this article.

The water enters the patent automatic measuring apparatus at the top of the plant where it flows into one of the oscillating buckets marked A.A. The bucket is filled to a certain height, and as soon as this height is reached, it is automatically released by the patent locking gear B, and in tipping discharges its contents into the rectangular intake tank below. At the same time the other bucket comes under the inlet pipe to be filled in its turn with water. The oscillation of the buckets to and fro operates, through a shaft and levers, the patent chemical discharge valve E which passes the amount of the reagents required to soften each separate measured amount of water. This chemical discharge valve is readily capable of precise adjustments to meet any variations in the hardness of the water.

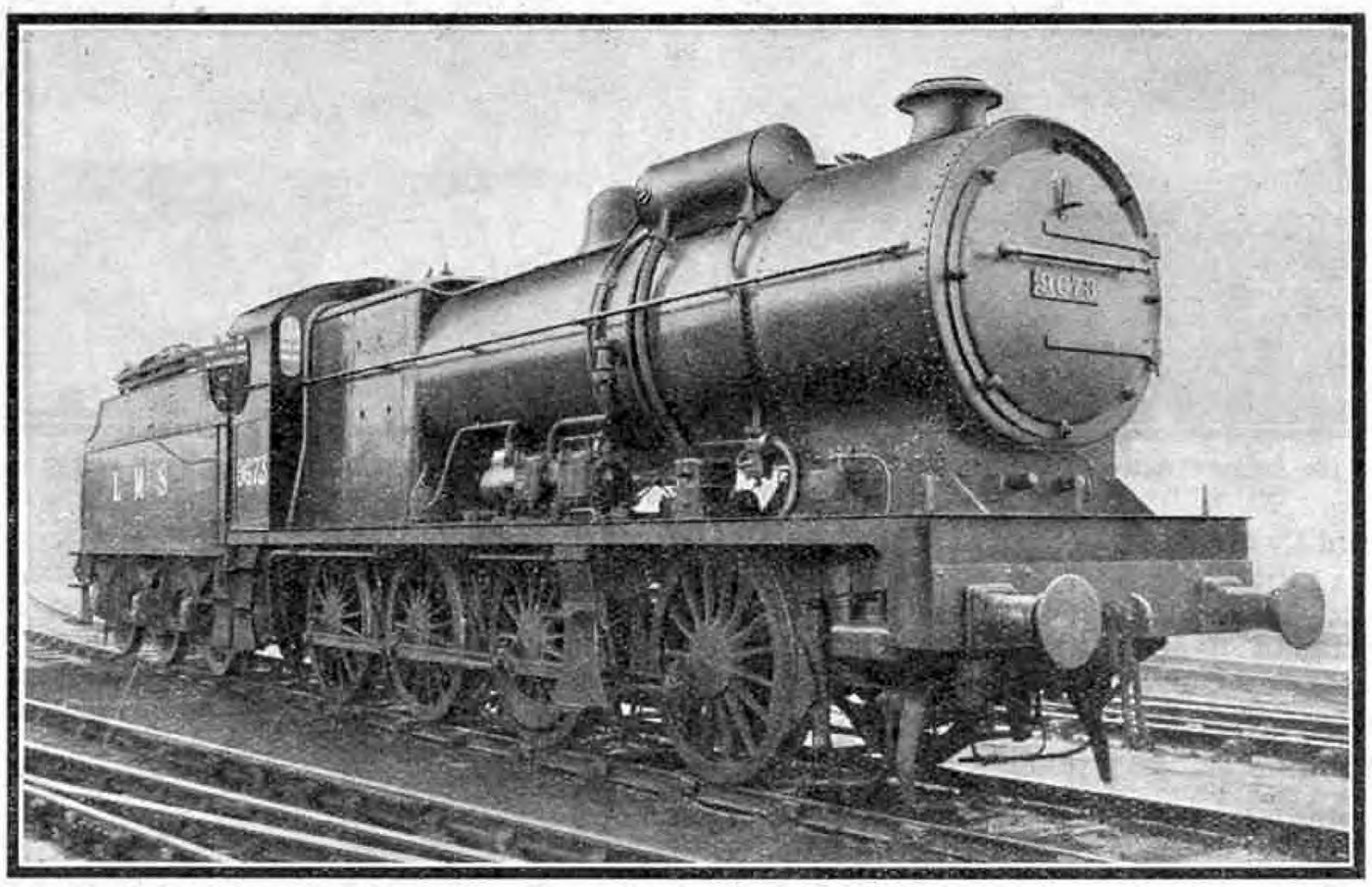
The mixing tank F, which is semi-circular in section, contains the chemical reagents in solution, and they are maintained in a state of admixture by means of mechanical stirring apparatus that works continuously during the operation of the plant. From the intake tank the mixture of water and chemicals flows through the central downtake pipe G. The heavier precipitate of calcium carbonate is deposited to the bottom of the settling tank H, whence it is drawn off periodically by means of the sludge valve shown. The water rises through the wood fibre filter above the settling tank and then is drawn off into a reservoir or water tank ready for the use of locomotives.

Altogether five plants on this principle have been provided by the United Water Softeners Ltd. Other types of softening plants are in use, the 16 by the Paterson Engineering Co. Ltd., being the most numerous. Among these is the smallest plant in the whole installation, that at St. Albans, where a modest 2,000 gallons are dealt with hourly. Two plants each have been supplied by Wm. Boby & Co. Ltd., the Kennicott Water Softener Co. Ltd., and the Becco Engineering & Chemical Co. Ltd.; and one by Bell Bros. Ltd. Thus six types of softeners are employed, different in the details of their operation, but all similar in principle and purpose.

Other groups, of course, and railways abroad have softening plants in operation, and some of them have been in service for many years, but the L.M.S.R. installation is specially notable for its extensive character. It is interesting to note that in Canada, in districts where it is not considered profitable to erect water-softening plants, the water is treated by putting in the tender the lime and soda ash in the form of a brick, each time the tank is filled.

Another interesting development, with the object of reducing the amount of waste of water that has been softened at considerable expense is the special water-scoop deflector introduced by the L.M.S.R. This is fitted in advance of the water scoop on the tender, and such is its efficiency in reducing splash and overflowing at the troughs that it is estimated that its provision on all L.M.S.R. locomotives with water pick-up gear would yield an economy of 20 per cent of the amount of water used in the troughs.

In addition to provision for softening locomotive water supplies, experiments are also being made by the L.M.S.R. and L.N.E.R. with the A.C.F.I. feed-water heating apparatus.



L.M.S.R. 0-8-0 locomotive No. 9673. This is fitted with A.C.F.I. feed-water heating apparatus, which reduces the tendency to furring in the boiler, in addition to heating it. Photo courtesy L.M.S.R.

This includes a settling tank with an outlet, which permits of the escape of oxygen and carbon dioxide that are set free by the rise in temperature of the feed water. This apparatus, therefore, reduces the liability of the water to cause furring in the boiler, in addition to its function as a preheater of boiler feed.

The necessity for water treatment and for the avoidance of waste may be gathered from the fact that the total consumption of water on the L.M.S.R. alone amounts approximately to fifteen thousand million gallons annually. If the total amount of scale deposited by this huge quantity of water—most of it is comparatively hard—were loaded into wagons, they would require about 20 locomotives to move them. In America 50,000 tons of deposit are removed in a year by water softeners.



New Height and Speed Records

The only two important aeroplane records held by England have now been lost. These were the records for height, and speed over a 100 km. circuit, set up by Flt. Lt. Cyril Uwins and Flt. Lt. J. N. Boothman respectively. The new height record was gained by M. G. Lemoine, who attained an altitude of about 13,660 metres, equivalent to 44,820 ft. in a Potez 50 biplane equipped with a geared and supercharged Gnôme-Rhône K.14 engine. This was the thirteenth ascent to an altitude of more than 39,360 ft. made by M. Lemoine while attempting to gain the world's record. The height reached by Flt. Lt. Uwins was 43,976 ft.

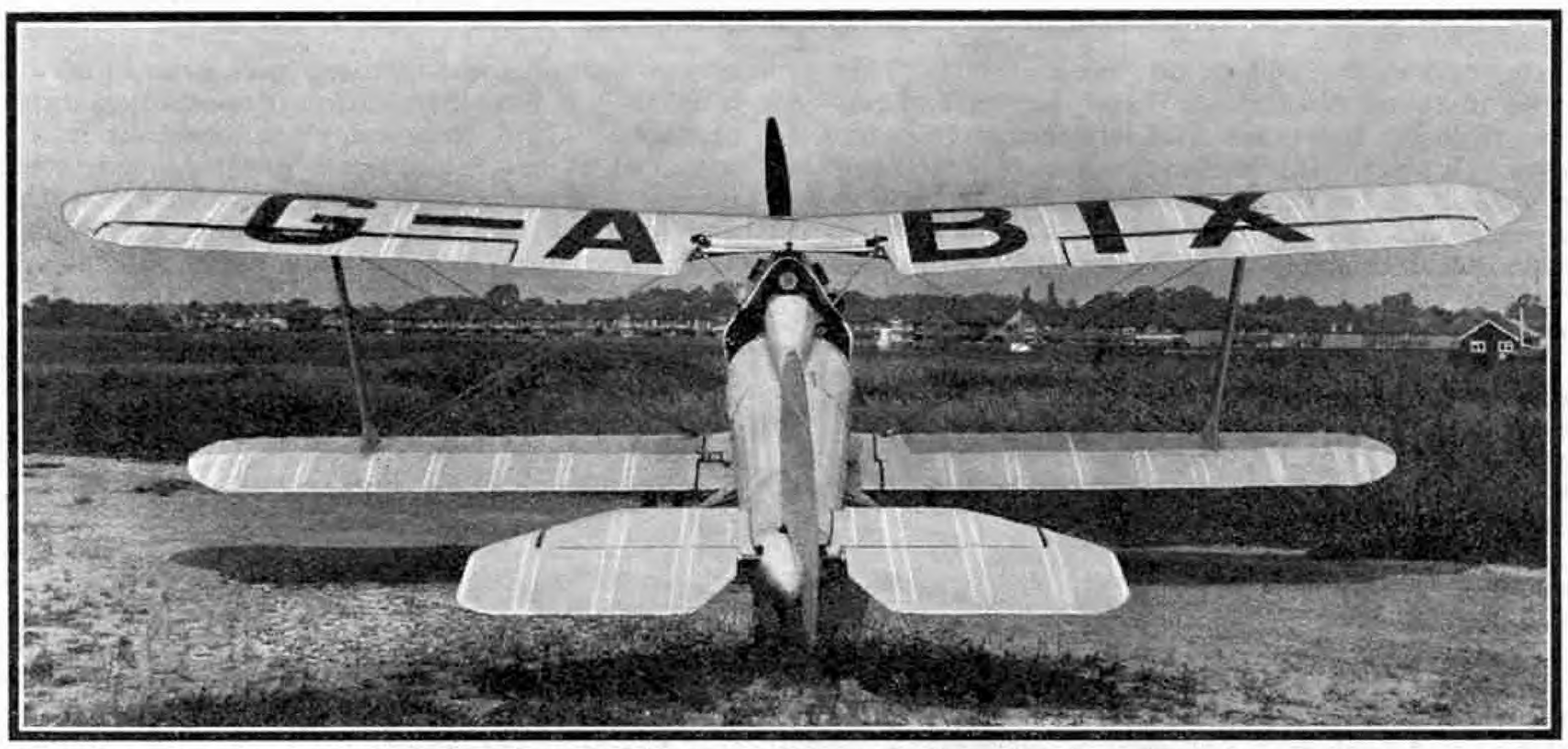
The record for speed over 100 km. was gained by Lt. Col. G. Cassinelli, who flew at a speed of 390.8 m.p.h. over the circuit in a Macchi-Castoldi 72 seaplane equipped with a Fiat A.S.6 engine developing 2,400 h.p. The speed achieved by Flt. Lt. Boothman over a similar course was 342.7 m.p.h., during the 1931 Schneider Trophy contest.

Another Comper Machine

A new three-seater low wing cantilever cabin monoplane, known as the "Mouse," has been produced by the Comper Aircraft Co. Ltd., the makers of the famous Comper "Swift" single-seater monoplane that is claimed to be the smallest aeroplane in the world. The new machine has a number of special features, and is fitted with a D.H. "Gipsy Major" engine that gives it a cruising speed of 130 m.p.h. for 600 miles.

One of the most important of the special features of the machine is the retractable undercarriage. This consists of two units each carrying a wheel and each separate in itself, arranged so that the units can be swung up into the wing, by means of two levers in the cockpit, as soon as the machine is off the ground. In order to prevent a pilot from landing without lowering the wheels, a red lamp on the dashboard is arranged to light up as soon as the throttle lever is pulled back. Another important feature is the method of folding back the wings. These are attached to the centre section by pins in the normal manner, but when the pins have been withdrawn the wing is not just swung back, but is pulled away from the centre section. It remains supported on a short tube, and it is rotated about this tube until the leading edge is pointing to the ground. The tube is hinged so that the wing can then be folded back against the fuselage. This reduces the overall folded width of the machine and also protects the main spar fittings from wear.

The cabin of the machine is provided with a sliding roof that can be pushed back when the machine is in the air, a very useful arrangement for landing when visibility is poor, as it enables the pilot to put his head out of the cabin. It is also useful when making a forced landing under conditions that may lead to the aeroplane's turning over, for the occupants will then be thrown out of the machine and not be shot through the cabin roof. The seats in the cabin are arranged so that the two pilots are in front, with the remaining occupant in the rear. Either of the front seats may be unfastened, however, and slid back to facilitate conversation with the person sitting at the back. The machine is constructed wholly of wood. The "Mouse" has an overall span of 37 ft. 6 in. and is 25 ft. 1 in. in length, and 11 ft. 10 in. in width when folded. When empty it is 1,300 lb. in weight, and is 2,215 lb. in weight when carrying full load.



Rear view of the Arrow "Active" single-seater light biplane. This machine is capable of a maximum speed of 140 m.p.h. Our photograph is published by courtesy of Arrow Aircraft (Leeds) Ltd.

Aviation in Canada

Work is now proceeding rapidly on the establishment of an air route across Canada. The development of this vast undertaking has been curtailed through the necessity for economy, but difficult sections of the route, such as over the Rockies and along the northern shore of Lake Superior, are being plotted and flown experimentally. Aerodromes necessary for the service are also being prepared, much of the necessary labour being provided through unemployment relief schemes for young men who receive food, accommodation and pay for their work. When the route is completed it will be one of the most remarkable in the world, for great directional beacons equipped with lights and wireless will stretch over the continent in a line, like huge street lamps standing 250 miles apart. Between a number of the larger cities in the Dominion, flying fields will be available at intervals of 25 miles and some 30 or 40 of these aerodromes have already been completed.

Air developments are also being pushed ahead in the north. Prospectors now fly to the scene of their labours instead of travelling on foot, and the great radium and mineral discoveries in the region of Great Bear Lake owe their rapid exploitation largely to the use of aeroplanes. It is probable that in a short time air routes between the north and south will be established on a scale comparable with those from east to west. It is interesting to note that the North West Mounted Police now seem to use aeroplanes much more than their famous horses!

Fast Fokker Passenger Machine

The recently produced Fokker F.XX is a fast transport machine in which speed has not been gained by sacrificing the comfort of the passengers. The new machine is fitted with triple engines and, when carrying a crew of three and 12 passengers, it has a guaranteed speed of 186 m.p.h. This high speed has been attained by streamlining and generally improving the aerodynamic form of the fuselage and of the engine nacelles, and also by employing a retractable undercarriage.

The machine is of the high wing cantilever monoplane type, the wings tapering in chord and thickness in the customary Fokker manner. They are of standard Fokker wooden construction, and the fuselage, which is elliptical in cross section, consists of a welded framework of steel tubes covered with fabric. The undercarriage is of the wide track type without an axle, and when the aeroplane is in flight the wheels and the supporting struts can be lifted up into the two engine nacelles by means of a hand wheel in the pilot's cockpit. A tail wheel provided instead of a tail skid is also retractable.

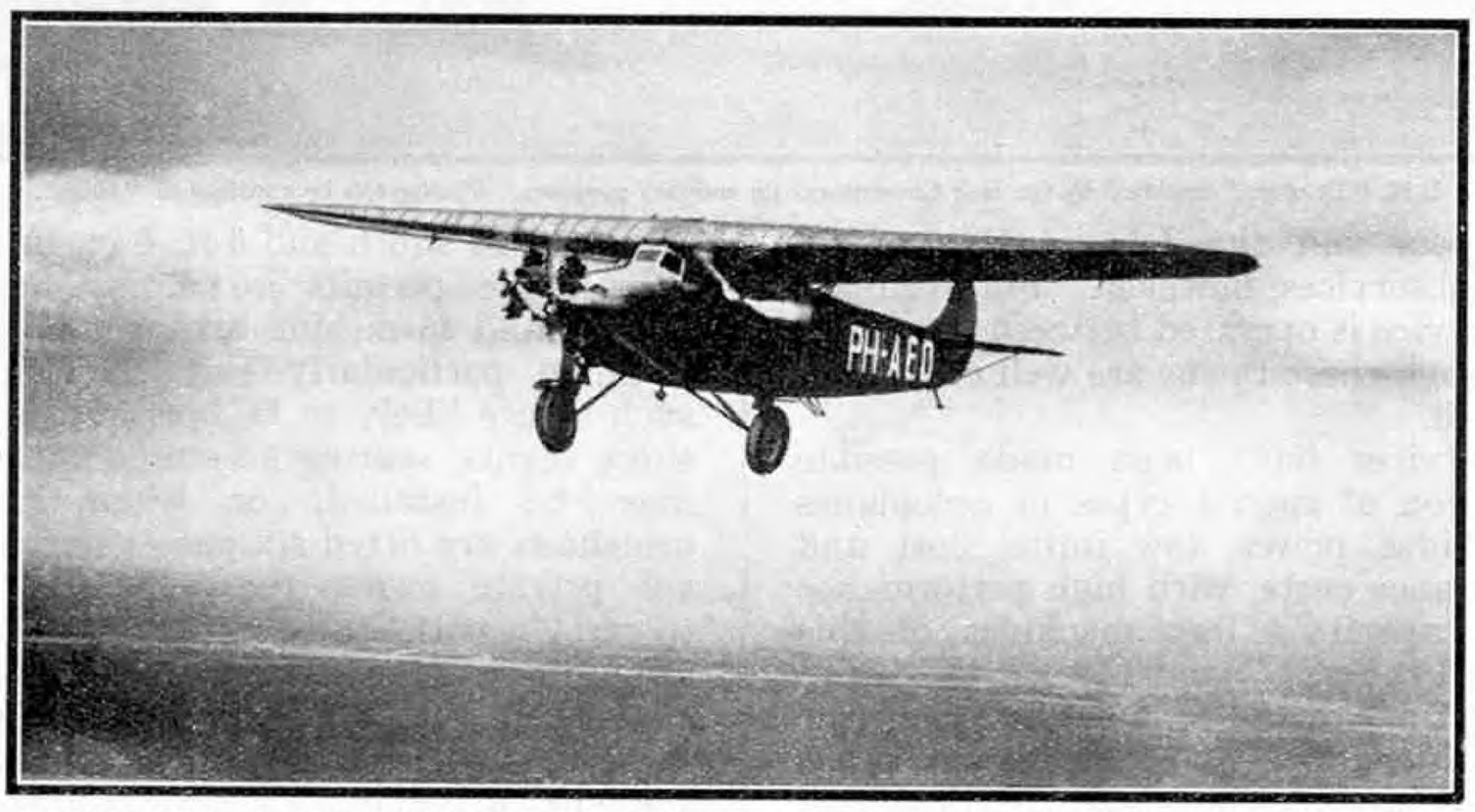
The accommodation consists of a small luggage hold behind the engine carried in the nose of the fuselage, while behind this, but in front of the leading edge of the plane, is an enclosed cockpit with side by side accommodation for two pilots. Near is a radio compartment, from which a sliding door leads to the passenger cabin, which is 16 ft. in length, 5 ft. in width and 6 ft. in average height, and has comfortable seats for the 12 passengers. The windows do not open, but in an emergency can be smashed without danger, to form exits. There are also two large emergency exits in the centre section. A ventilating system is provided to heat or cool the cabin. Behind the cabin is a luggage hold with a capacity of 42 cu. ft., and two further holds are provided between the wing spars. These are only accessible from outside the machine, and they have a total capacity of 95 cu. ft.

Three Wright "Cyclone" engines are employed, one being mounted in the nose, and the other two in nacelles slung below the wings. These give the machine a maximum speed of 186 m.p.h., and a cruising speed of 154 m.p.h. The minimum speed, without the use of special trailing edge flaps, is 73 m.p.h., but when these flaps are brought into service it is 64 m.p.h. The machine has an absolute ceiling of 19,500 ft., and with one engine out of commission is able to maintain an altitude of 10,500 ft. The range is 1,000 miles.

The machine is 90 ft. 2 in. in span and 54 ft. 1 in. in overall length. It is about 11,790 lb. in empty weight, and is capable of carrying a disposable load of 7,715 lb. The aeroplane has an all-up weight of about 9 tons.



The start of a flight in the Junkers "Junior" light low wing monoplane. This machine was described on page 847 of our last month's issue. Photograph by courtesy of Junkers Flugzeugwerke, A.G.



A Fokker F.VIIb—3m triple-engined high wing monoplane in operation on one of the air lines of K.L.M., or Royal Dutch Air Lines, to whom we are indebted for this illustration.

England-Canada Air Mail Service

It is proposed to inaugurate an air mail service between England and Canada next year. Liverpool is suggested as the British terminal of the service and Montreal as the Canadian terminus, the two places being joined by way of Greenland. Exhaustive geographical and meteorological surveys of the route have been made, and it does not appear that many difficulties would be experienced. We hope to publish further details of this interesting scheme immediately they are available.

Imperial Airways News

Air mail is now carried from London to Rangoon, the time taken being only eight days as compared with 23 days by surface transport, representing a saving by air of 15 days. Mails for Rangoon are first flown over the existing India route via Cairo, Baghdad and Karachi to Calcutta, whence they are flown over the new 700-mile section extending from Calcutta to Akyab and Rangoon. A return air mail service is also in operation. The rate for the despatch of a letter by the new service from Great Britain to Burma is 8d. for the first half ounce and 7d. for each additional half-ounce, while the through passenger fare is £135.

This new section forms another link in the 10,000-mile air mail route that is eventually to connect England with Australia; and brings the mileage now in operation up to 7,200. It is hoped that another section, connecting Rangoon and Singapore, will be open for traffic by Christmas, and it is expected that the final sections to Australia will be ready early next year.

A striking example of the time saving that can be effected in the despatch of urgent loads over long distances, by the combined use of air and ocean transport, was provided recently when an express parcel containing documents was consigned by air mail and ocean liner from Victoria, British Columbia to Nairobi, in Kenya Colony. This packet was flown by air mail to New York and was put on board the "*Europa*." After crossing the Atlantic, and when still 600 miles from Land's End, it was catapulted from the liner, together with other express mail, and flown to Southampton. After this the parcel was carried by Imperial Airways machines from London to Africa by way of France, Italy, and Egypt, and eventually reached Nairobi, after having travelled 10,000 miles in 13 days. By ordinary transport the journey would have occupied more than a month.

Among the strangest cargo ever carried by Imperial Airways was a number of live ladybirds, flown from Port Elizabeth to Tanganyika on the Africa service. These were needed to combat an insect plague in the coffee plantations. It will be remembered that a cargo of locusts was recently flown to this country.

British Aircraft Developments

IX.—The De Havilland "Dragon"

DURING the past year the most remarkable feature of aviation in this country has been the development of internal air lines. For many years it has been said that there were only small possibilities for air services in this country on account of the comparatively short distances to be covered and the efficiency of the existing rail and road transport services. This reasoning has been proved false, however, for not only have many services been operated, but also they have been run at a profit and without subsidy. In some instances the services are operated between places where the existing methods of surface communication are slow, or have of necessity to follow circuitous routes. Examples of these are the services between Portsmouth and Ryde, in the Isle of Wight; between Plymouth and Cardiff across the Bristol Channel; and between Liverpool and the Isle of Man. This is not the case with all services, however. For example, a highly successful service is operated between Liverpool and Blackpool, although these towns are well connected by both road and rail.



A D.H. "Dragon" employed by the Iraq Government for military purposes. Photograph by courtesy of "Flight."

These internal services have been made possible only by the production of special types of aeroplanes that combine low horse power, low initial cost and running and maintenance costs, with high performance and high carrying capacity. Two machines of this type are the Airspeed "Ferry" and the De Havilland "Dragon." The first of these we described on page 844 of our issue for November, 1932, and in this article we deal with the "Dragon," which may be described as an air liner in miniature.

The "Dragon" is a twin-engined biplane with accommodation for one pilot and between six and ten passengers, according to the arrangement of the accommodation and the size of the luggage compartment. An interesting feature of the machine is that it is constructed wholly of wood. In the past the greatest handicap of wooden structures has been that they were not capable of standing up to varying climatic conditions; but the De Havilland Aircraft Co. Ltd. discovered that if a wooden structure is adequately protected it will stand up to climatic conditions as well as, if not better than, a metal structure. Wood construction is of course cheaper and lighter than metal, and is sometimes claimed to be safer. Fatigue and deterioration are difficult to discern in metal without special apparatus, and when they are discovered are difficult to repair without special jigs and skilled labour. Damage to wood, on the other hand, is easily seen with the naked eye, and can be repaired without difficulty by unskilled labour. The wooden parts of the "Dragon" are protected by a nitro-cellulose finish, while the three-ply that covers the fuselage is additionally protected by fabric.

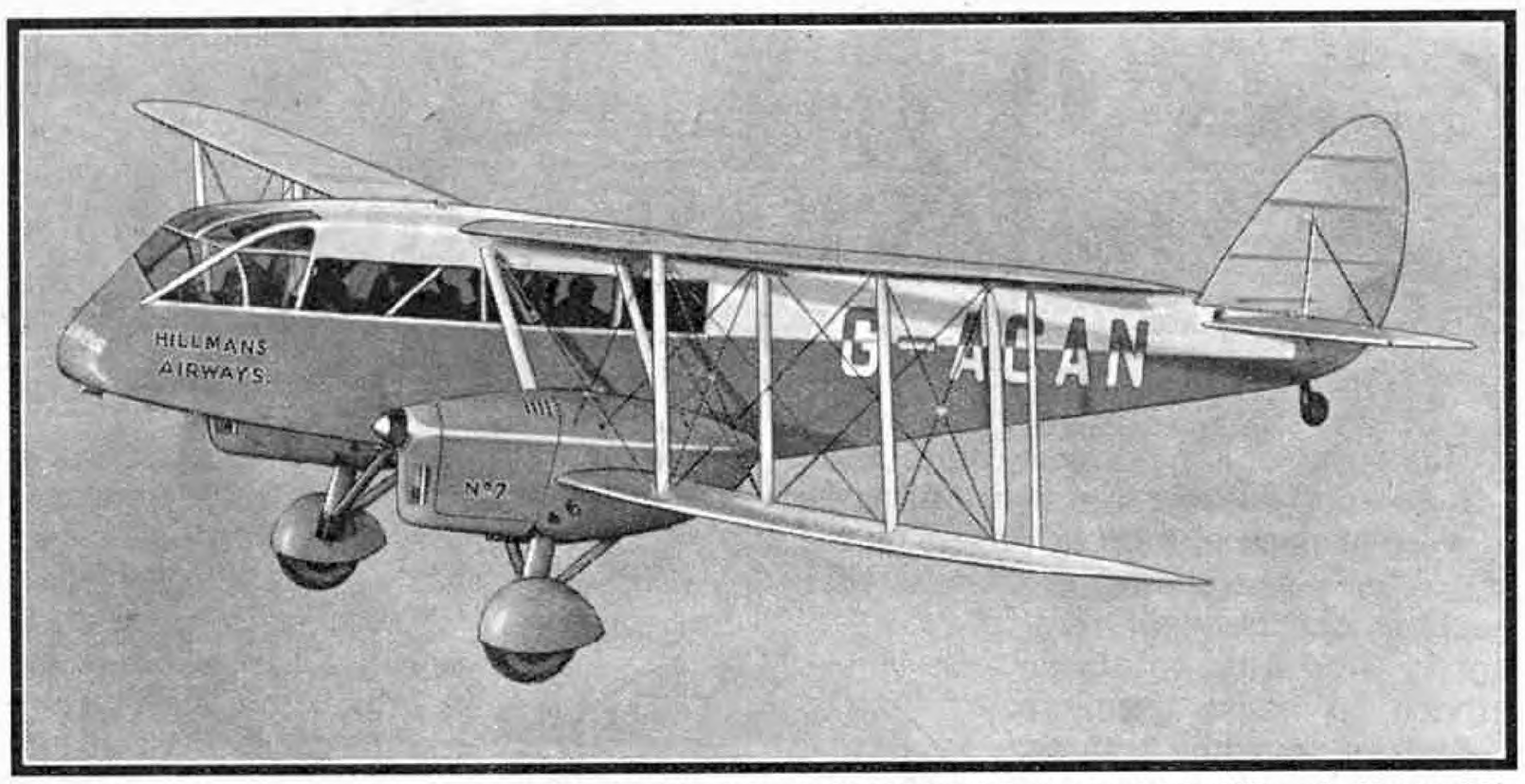
The fuselage of the "Dragon" is 34 ft. 6 in. in overall length, and as both engines are mounted outboard on the lower wings, the pilot's seat is situated right in the nose of the machine. Behind this is a cabin for the passengers, approximately 9 ft. 9 in. in length, 4 ft. 6 in. in width and 4 ft. 6 in. in height. The ample floor space permits an almost indefinite variety of seating and furnishing arrangements, which makes the machine particularly suitable for short air services such as are likely to be operated in this country. For short flights, seating accommodation for 10 passengers may be installed, or when luxurious adjustable armchairs are fitted six passengers can be carried. For the private owner the "Dragon" can be arranged to carry a party of four in long and deep lounge chairs, in addition to a refreshment buffet with a seat for a steward. With the cabin stripped of its furniture and appointments, space is available for 1,300 to 1,400 lb. of freight or mails.

The cabin is heated by a special device by which warm air from the engine is distributed over the floor, a controllable air duct being fitted to each seat for the admission of fresh air.

The fuselage carries a wide track undercarriage of the split type, and a tail wheel at the rear. The wings of the machine have two bays, and a special feature is that the fuselage takes up the whole of the gap between them, making the machine very easy to distinguish when it is in the air. The wings have a span of 47 ft. 4 in. but can be folded back, when the overall span of the machine is 25 ft. 4 in. The engines are mounted on the fixed inner sections of the lower planes, and these

sections are braced upward to the top longerons of the fuselage by special steel tube struts on each side.

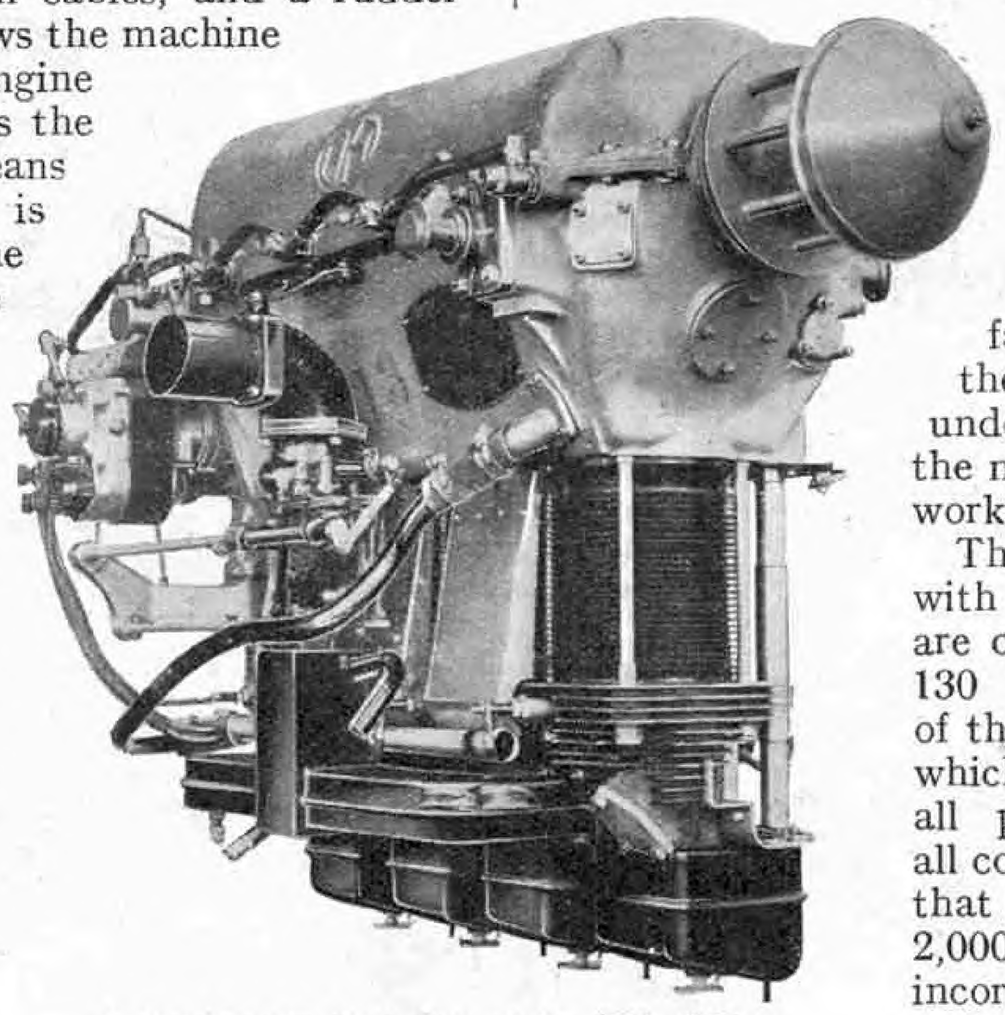
An outstanding feature of the "Dragon" is the ease with which the controls can be inspected and maintained. All the flying and engine controls are led through the floor of the cockpit and are housed in a false bottom to the fuselage, consisting of fabric laced by "zip" fasteners, that run from end to end of the fusclage. When these fasteners are undone all the controls are immediately accessible. The aileron control is by means of a wheel on the top of the control column, which works the elevators by means of cables. Ball bearings are used at all important working points.



This "Dragon" is employed on the unsubsidised service between Romford and Paris operated by Hillman's Airways Ltd. Photograph by courtesy of "The Aeroplane."

Directional control is by a parallel motion rudder bar operating a rudder through cables, and a rudder trimming gear is fitted that allows the machine to be flown feet off with one engine stopped. A wheel that controls the incidence of the tailplane by means of an irreversible worm gear is situated on the port side of the cockpit. All control cables are duplicated.

The "Dragon" has a tare weight of 2,285 lb. and is 4,200 lb. or nearly two tons in all-up weight. When fitted with two "Gipsy Major" engines operating at 2,300 r.p.m. it has a maximum speed at sea level of 130 m.p.h. and a cruising speed at 1,000 ft. of 110 m.p.h. Its stalling speed is 54.5 m.p.h., and under normal conditions it requires a run of 165 yds. to take off, the time taken being 14½ seconds. It can maintain flight with one engine out of commission, when its absolute ceiling is 3,500 ft. and the cruising speed at 1,000 ft. 75 m.p.h.



A three-quarter front view of the D.H. "Gipsy Major" engine, two of which are employed on the "Dragon." Our photograph is published by courtesy of the De Havilland Aircraft Co. Ltd.

Probably the greatest feature of the machine is its low operating cost per passenger seat. The "Gipsy Major" engine is designed so as not to require aviation spirit. When carrying six passengers and cruising at 110 miles per hour, the machine consumes 13 gallons of fuel per hour. Taking the retail cost of ordinary motor spirit at 1s. 7½d. a gallon, the fuel cost is therefore approximately one-third of one penny per passenger mile. In other words, six passengers could be flown from London to Paris at a fuel cost of 7s. 7d. per passenger, each passenger carrying 45 lb. of luggage.

An interesting development of the "Dragon" is its ready adaptability to what has come to be known as the "*type colonial.*" This means a type of machine that can be used as a normal passenger or goods aeroplane, but can be employed also for the disciplining of unruly tribes in case of need. The development of the "Dragon" for this purpose entails the extension of the cabin space to include the luggage compartment, the fitting of a gunner's platform with gun ring in the roof of the cabin, an alternative gun position in the floor, a fixed gun firing forward from the pilot's cockpit, and bomb racks, release gear and sights, wireless and rough seating for troops or police. When in this form, and also when fitted for normal commercial flying, the "Dragon" can easily accommodate injured people on stretchers.

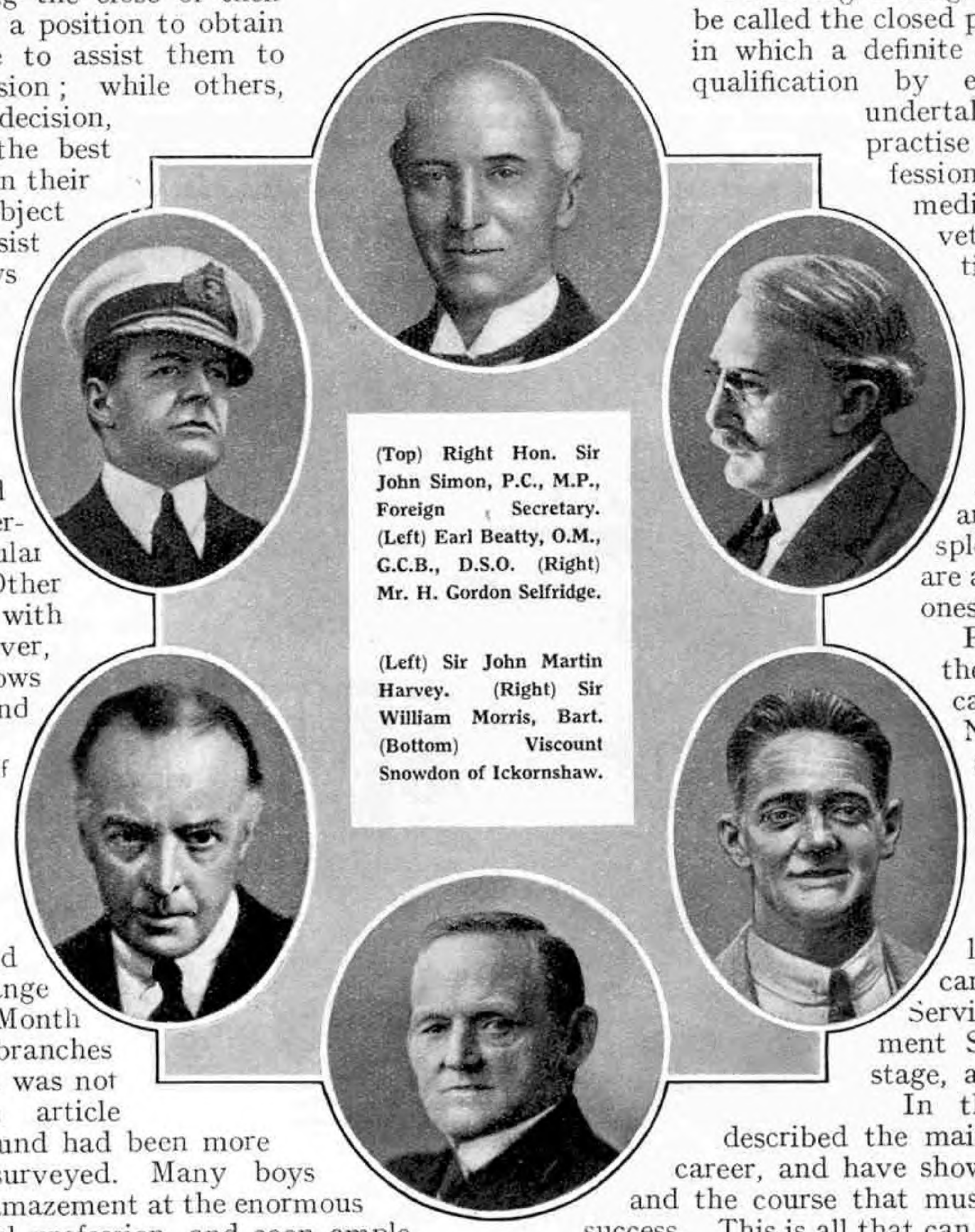
The absolutely unobstructed downward and forward view gained by the absence of an engine in the cockpit, and the fact that the undercarriage is of the split type, which leaves the underside of the fuselage clear, makes the machine admirable also for survey work, mapping, and aerial photography.

The D.H. "Gipsy Major" engines with which the "Dragon" is equipped are of the inverted type, and develop 130 b.h.p. They are developments of the "Gipsy" I, II and III engines, which have given excellent service in all parts of the world and under all conditions. Actually the experience that has been gained from more than 2,000 "Gipsy" engines has been incorporated in the "Gipsy Major," and troubles that have been experienced in previous types have been rectified in this. Many improvements also have been incorporated, the most striking probably being the fitting of aluminium-bronze cylinder heads, which obviate the necessity for separate valve seats or sparking plug adaptors, and also prevent distortion of the cylinders. In the "Dragon" the engines are mounted in special cowlings, each of which carries a petrol tank of 30 gallons capacity from which fuel is fed to the engines through duplicated fuel pumps. An oil tank capable of holding two gallons is contained in the lower cowling of each engine, oil being fed to the engine through duplicated pumps.



IN October, 1929, this series of articles was commenced as the result of an ever-growing number of letters from boys who were in need of help in regard to the choice of a career. This correspondence showed that many boys approaching the close of their schooldays were not in a position to obtain really practical advice to assist them to make their final decision; while others, who had made this decision, were in doubt as to the best method of entering upon their chosen career. The object of the series was to assist both these classes of boys by dealing with the various occupations one by one. Forty-eight careers, covering all the main professions, have been described in detail, and the series has now terminated as a regular monthly feature. Other careers will be dealt with from time to time, however, as correspondence shows that there is a demand for them.

As most readers of the "*M.M.*" are specially interested in engineering, it was decided that the series should commence with this profession, and immediately its vast range became evident. Month after month different branches were dealt with, but it was not until the thirteenth article appeared that the ground had been more or less completely surveyed. Many boys wrote to express their amazement at the enormous scope of this wonderful profession, and soon ample proof was forthcoming of the value of this section of the series. Letters arrived day after day from both boys and parents, asking for further details of the various branches; and although the time was one of intense industrial depression, we had the satisfaction of knowing that the information and advice given was the means of enabling many boys to decide upon an engineering career, and to make a start on right lines. Trade conditions are now definitely improving, and there are signs that engineering will soon regain a good deal of the prosperity that it lost during the aftermath of war.



(Top) Right Hon. Sir John Simon, P.C., M.P., Foreign Secretary. (Left) Earl Beatty, O.M., G.C.B., D.S.O. (Right) Mr. H. Gordon Selfridge.

(Left) Sir John Martin Harvey. (Right) Sir William Morris, Bart. (Bottom) Viscount Snowdon of Ickornshaw.

From engineering we turned to what may be called the closed professions, that is those in which a definite course of training and qualification by examination must be undertaken before anyone can practise that particular profession. These include medicine and surgery, veterinary surgery, dentistry, the law, and accountancy. Owing to the cost of training involved, only a comparatively small number of boys can hope to enter these professions, but in our articles we showed the splendid opportunities that are afforded to the fortunate ones who are able to qualify.

Passing on, we described the special features of careers in the Army, the Navy, the Air Force, and the Police Force, with their strong appeal to boys of good physique and an adventurous spirit. Then followed a miscellaneous selection of careers, including the Civil Service, the Local Government Service, music, art, the stage, and photography.

In these articles we have described the main requirements of each career, and have shown the method of entry and the course that must be pursued to ensure success. This is all that can be done in such articles, and the responsibility for the actual choice of the career still rests with the boy. We have as it were spread out on view practically all the recognised professional careers, but the selection must be made by each boy individually.

As regards careers, boys may be divided roughly into two classes, those who have a career marked out for

them in advance, and those who are left entirely free to make their own choice. The first class includes the boy who is intended to take up the career followed by his father. In many cases this is a profession such as medicine or the law, and the boy recognises from his early years that this is to be his life work. There are other boys whose fathers are in business, and who intend their sons to learn that business and in due course to assume an important position in it, or even to become its head. From most points of view such boys must be considered fortunate, and although at first the particular business may not appeal to them, they should consider long and seriously before throwing over the opportunity in favour of some other career that may at the moment appear more attractive.

The great majority of boys, however, have no such plain and direct way in front of them, and to a large extent the choice of their careers is in their own hands. Few decisions are so difficult to make, because most boys do not possess ability in one direction sufficiently outstanding as to settle the matter straight away. The average intelligent boy is interested in many widely-differing subjects, and has apparently equal ability in several directions. As a rule, however, a little thought will enable a boy to decide where his chief interest lies, but it does not follow that even this gives a definite clue to the career he should select. For instance, a boy may be interested in mechanical matters and be an expert Meccano model-builder, and yet be quite unfitted for an engineering career. Again, a boy who is keen on outdoor occupations, and is fond of animals, might make a very poor farmer. There is all the difference in the world between a hobby and a career.

A boy with mechanical interests, who has ideas of becoming an engineer, should sit down quietly and think over what this means. Is he prepared to go through a strenuous apprenticeship, working hard for long hours for five years for very small pay, and during this period not only to work during the day, but also to attend evening classes at an approved technical school? If he is not prepared to do this, then he had better choose some other career. A process of self-questioning of this kind should be applied by every boy to the career he has in mind, and in many cases it will be the means of preventing the taking up of an utterly unsuitable occupation.

Looking back over the series as a whole, one feature is seen to be common to all the occupations, and that is the necessity for a sound general education. There is little room in any profession to-day for a boy who is not well educated, and in many cases the possession of a Matriculation certificate or of the school leaving certificate is essential at the outset. It is true that in the past many men who became famous engineers had little schooling, but they were exceptions, and they succeeded in spite of their lack of education, by outstanding ability and desperately hard work. Times have changed, and it is probable that men of their type, however gifted, would be unable under present conditions to force their way to the top of the tree. The hard fact remains that, nowadays, a boy who has not had a good education starts life with a serious handicap that he is never likely to overcome. In many professions certain definite examinations have to be tackled, and failure to pass these means that the way is completely barred. A boy who has made the most of his opportunities during the last two or three years of his schooldays will find these examinations far easier than one who has slacked, and has to make up lost ground at a time when he should be concentrating his energies on the special requirements of his career.

In making the change from school to work in office, workshop, factory, or elsewhere, a boy sets out on the great adventure of life, and his whole future may depend upon how he faces his new problems.

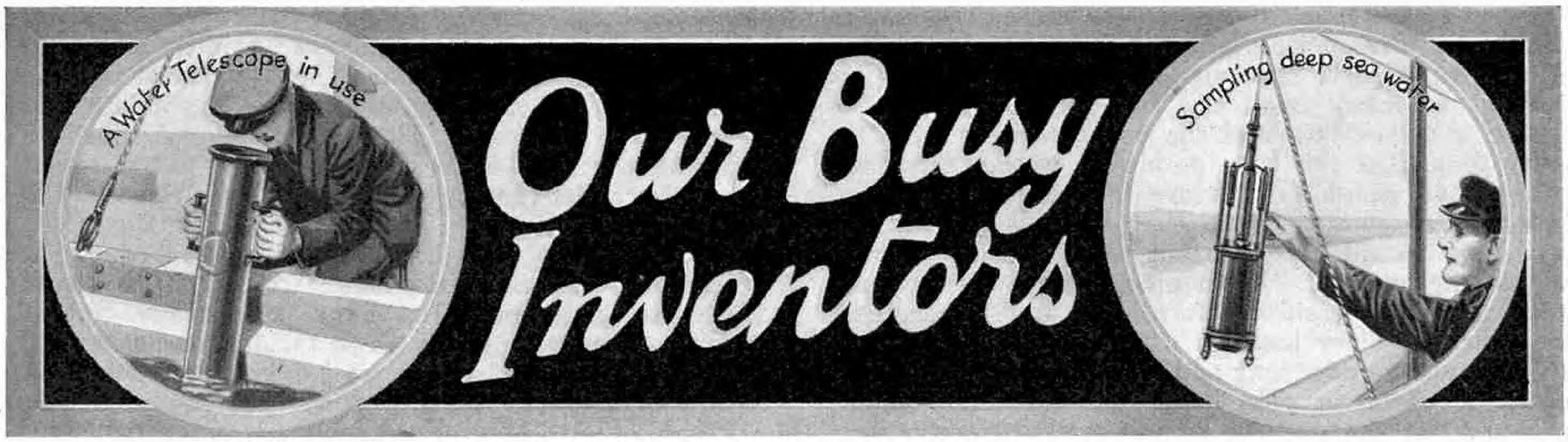
For a considerable period his work is almost certain to consist of routine jobs which, once learned, seem monotonous and uninteresting. This period actually forms a testing time. If a boy allows himself to drift into an automatic performance of his duties, doing just what is required of him and no more, and watching the clock as the afternoon draws on, he is making a bad start. His attitude will be noticed by those in authority, and he will be marked as undeserving of promotion. On the other hand, a boy who realises that this routine work forms the first rung of the ladder that leads to success, will carry out even the dullest jobs with alacrity and keenness. His attitude also will be observed, and gradually he will be entrusted with jobs a little more important and more interesting. His keenness will arouse interest in those about him, and he will be given far more instruction and help than the half-hearted boy, whether he is apprenticed or not. Success is assured to the boy who works with a will, carrying out to the best of his ability the duties that fall to his lot at any moment, yet always looking ahead and preparing himself to be ready for promotion when the opportunity arrives.

For the benefit of new readers we give in the panel above a complete list of the articles in this series. Any of these issues, except those marked with an asterisk, which are out of print, may be obtained from this office, price 8d. post free. Readers who require further details concerning any of the careers are invited to consult the Editor, who will do his best to help them.

Articles in the "What Shall I Be?" Series

Mechanica Engineering	November	1929	Naval Architecture	November	1931
Electrical Engineering, 1	December	1929	Veterinary Surgery	December	1931*
Electrical Engineering, 2	January	1930*	Dentistry	January	1932*
Wireless Engineering	February	1930	Teaching	February	1932*
Railway Engineering	March	1930	Surveying	March	1932*
Marine Engineering	April	1930	Secretarial Work	April	1932
Automobile Engineering	May	1930	Farming	May	1932
Aeronautical Engineering	June	1930	Police Force	June	1932
Coal Mining Engineering	July	1930	Royal Air Force	July	1932
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Oil Engineering	September	1930	The Royal Navy	October	1932
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Civil Engineering	November	1930	The Post Office	December	1932
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Accountancy	February	1931*	The Stage	March	1933
Medicine and Surgery	March	1931*	General Railway Careers	April	1933
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Banking	May	1931	Local Government Service	June	1933
Insurance	June	1931*	Photography	July	1933
Journalism	July	1931	Ophthalmic Optician	August	1933
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Pharmaceutical Chemistry	October	1931	Process Engraving	November	1933

* Out of Print



By P. A. Tent

FOR many years the Barimar firm, who are well-known in connection with welding work, have been experimenting with a process for welding cast-iron at comparatively low temperatures. I am informed that they have at last succeeded in welding cast-iron at only half the temperature previously thought to be necessary. Great skill on the part of the welders is required, however, for there is a complete change in the method by which the flame of the blow-pipe is applied ; and special fluxing compounds are necessary. The chief advantage of the newly invented process is claimed to be that large castings can be welded without dismantling. Incidentally, although the metal deposited in the process can be worked with a file, it has qualities that make it longer wearing than cast-iron.

British Car with Infinitely Variable Gear

Many inventors are at work on the problems of automobile transmission gear. Some are endeavouring to discover an infinitely variable gear—a satisfactory solution to which problem has eluded engineers for so long. What is wanted is an infinitely variable gear that is not only automatic but does not require any power in its operation, and it seems as if this demand has now been met, for a British car, the 16 h.p. Austin, has been fitted with a device of this kind, known as the Hayes gear box, that is completely automatic in action. Whether the car is running on the level or uphill, the gear always adjusts itself to the ratio that is most favourable for the purpose, the changes being brought about by variations in oil pressure generated by means of a pump driven by the engine.

The control of a car fitted with this device is remarkably simple. On the steering wheel is a lever mounted on a small quadrant. When starting the driver merely places the lever in a position marked " Forward " and lets in the clutch, and in driving then makes use only of the accelerator and steering wheel. Neutral and reverse positions also are marked on the quadrant.

Several patents have been taken out recently for automatic change-speed mechanisms, particularly for commercial motors where the wear and tear on the gear-box is very great owing to necessity for heavily loaded vehicles constantly changing gear on gradients. Ruston and Hornsby Ltd., the well-known engineering firm of Lincoln, have recently patented a change-speed gear device for very heavy work as carried out, for instance, by road rollers, armoured cars, and heavy duty lorries.

Inventions and Patents at Great Exhibition

At the Shipping, Engineering, and Machinery Exhibition, held a few weeks ago, there were many ingenious inventions and patented devices to be seen. This is the twelfth exhibition of its kind, at which for a fortnight Olympia becomes a meeting place for all engineers all over the world. Among the most important exhibits this year were many new designs of oil engines, the horizontal type of which appears to be coming to the fore again.

Among the submarine signalling devices displayed was an improved exhibit (shown by the Submarine Signal Company Ltd.). These instruments depend on sounds sent out at intervals by an electric oscillator installed near the keel of a ship. The sounds are reflected from the sea-bed and are received by a special apparatus that electrically measures the interval of time between the sending out of the sound and its reception. This interval depends, of course, on the depth of water beneath the vessel, as was described on page 104 of the "*M.M.*" (February 1933). The improved " Fathometer," as this instrument is called, is produced at a reduced cost and is more easily installed than the earlier types, as it is not now necessary to dry-dock the ship to cut away the skin in order to fit it. Some of the instruments are so delicate that they are able to indicate depths of 90 or even 45 fathoms, and these are of particular use on such craft as trawlers and channel steamers.



The Fathometer, an instrument that automatically and instantaneously records the depth of water below vessels to which it is fitted. Photograph by courtesy of the Submarine Signal Company (London) Ltd.

In a very ingenious chain clutch (exhibited by the Renold and Coventry Chain Co. Ltd.) the links are made to serve as the toggles of a clutch, on a somewhat similar principle to that of a bicycle free-wheel. On this same stand was to be seen a bewildering variety of applications of chains of all sizes and descriptions. The writer well remembers a Scottish Six-Day Motorcycle Trial of many years ago, when he rode one of the first motor cycles to be fitted with chain drive. The number of times that the chain broke during the Six Days was appalling, and much time was lost every day in effecting the necessary repairs. Yet such are the improvements that have since been made that one of these modern chains was tested to withstand a breaking strength of 85,000 lb., or nearly 40 tons, being suitable for transmission of power from an engine of 1,200 h.p. !

Making Use of X-rays in Industry

Recent developments of X-rays in connection with industry were illustrated by the exhibits of Messrs. Philips Lamps, who showed apparatus used in the examining of ship's plates, and welds in steel up to $\frac{3}{4}$ in. in thickness. This new development is of great value as it does not require specially skilled operators. It is becoming increasingly popular for examining and testing, not only in ship-building but also in other branches of industry, as for example, riveting and casting.

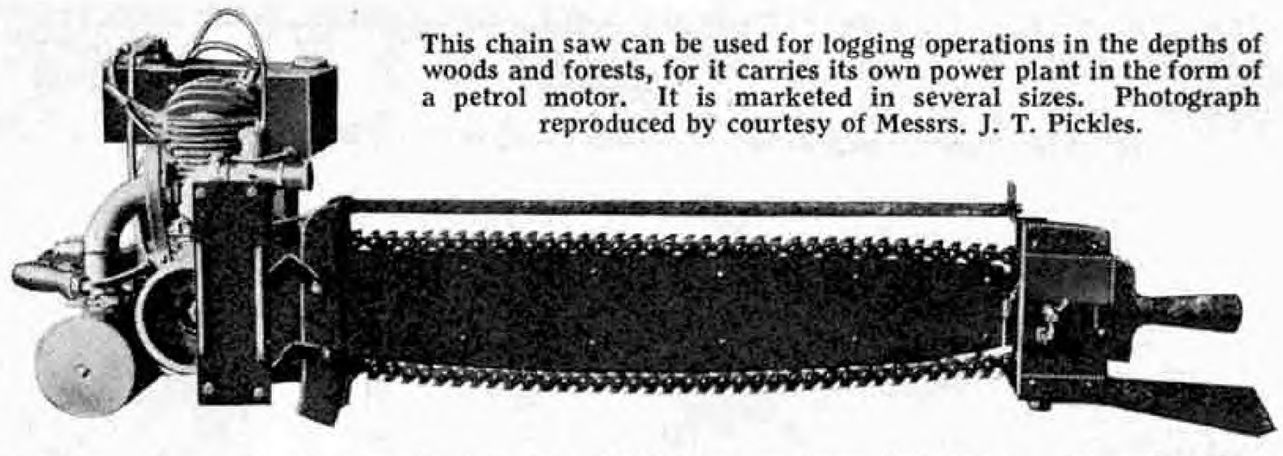
A bewildering variety of instruments was exhibited by Negretti and Zambra, including thermometers for a wide range of temperatures and for special purposes, humidity controllers, and boiler house instruments. A very interesting device is an automatic temperature controller. It works by means of compressed air and a Bourdon spring that controls the opening of a valve in the fuel supply pipe. Should the temperature drop below a predetermined figure, the valve is opened and more fuel is admitted to the furnace, the opposite taking place should the temperature increase beyond the required limit. The ingenuity of the device is the means by which a fine adjustment can be given to the throttling action, thus avoiding uneven rises and falls.

Bosch Ltd. exhibited handy electrical apparatus, including an electric grinder used for finishing work that has become distorted

during hardening, and for smoothing off rough edges and polishing. It works at 50,000 r.p.m., is cooled by a built-in fan, and is used for machining steel, iron, bronze, silver, glass, and even precious stones. An electric screwdriver is very useful for repetition work ; it is easy to manipulate, the blade coming to rest immediately a screw has been driven home.

Chain Saw Carries its Own Power Plant

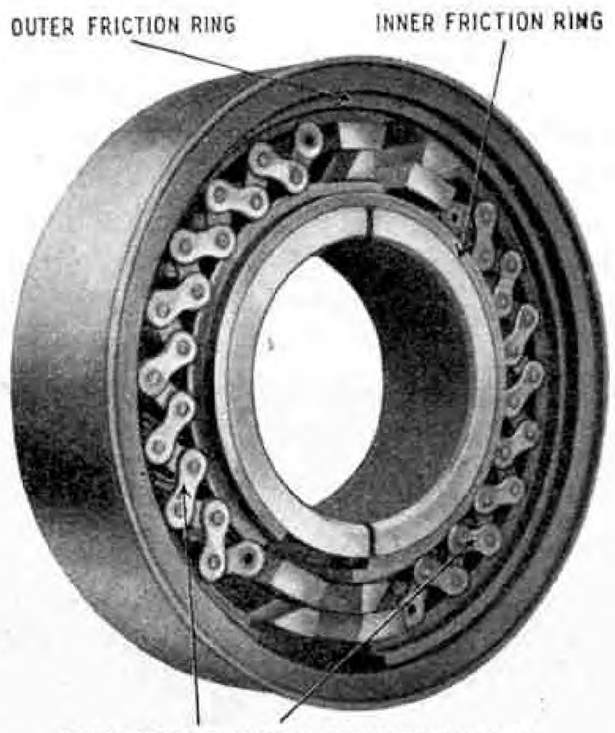
The " Lynx " motor saw, which is driven by a petrol motor, is another interesting novelty capable of many uses. As the accompanying illustration show, it consists of a continuous link saw that runs in a convex steel guide track. An air-cooled two-stroke engine is included in the design, together with a tank holding half a gallon of fuel. The " Lynx " saw therefore incorporates its own power plant, and may be used for cutting down trees and sawing logs in the depths of woods and forests, where saws driven by electricity or compressed air cannot readily be employed. A special device enables it to be operated horizontally, in which position it is invaluable for cutting off the tops of piles after these have been driven into the ground to the required distance. The invention is marketed in several sizes. The largest of these is 5 ft. in length and weighs about 75 lb., and is readily operated by two men.



This chain saw can be used for logging operations in the depths of woods and forests, for it carries its own power plant in the form of a petrol motor. It is marketed in several sizes. Photograph reproduced by courtesy of Messrs. J. T. Pickles.

A very practical device that has recently been introduced is the " Luminex " Magnifier illustrated on this page. Lack of illumination sometimes makes it difficult to examine small objects by means of a powerful magnifying glass that must be held near to them, the head or hand of the observer often cutting off light. In the " Luminex " Magnifier a small electric light bulb provides all the illumination that is needed, the light being directed by means of a parabolic reflector on to the object over which the lens is held. The device has been found very useful in examining textile materials and in revealing fine details in photographs. Special instruments containing scales for measuring purposes are available, and in one magnifier of the " Luminex " range the simple lens is replaced by a compound microscope giving a magnification ratio of 40 to 1.

I see that Sir William C. Dampier, F.R.S., has been saying that there is a great need for easier facilities for the financing of approved inventions in their early days and before they are ready for a public appeal. He suggests that perhaps a corporation under the common control of our bankers might undertake this, with a committee of men of science to advise on the technical soundness of new ideas. As Sir William pointed out, German bankers are willing to finance new inventions and to start new industries, leaving their money in them for many years. Our own bankers do not think that this is the function of a bank, however, and are determined to keep their resources more liquid. There must be many inventors who have inventions of commercial possibility but who are prevented from developing them through lack of means, and it is to be hoped that something will be done to deal with the situation.



An ingenious chain clutch that acts on a similar principle to the free wheel of a bicycle. For our illustration we are indebted to the Renold and Coventry Chain Co. Ltd.

Drumm Battery-driven Train Successful

I am reminded that there is a large scope for inventors in the field of storage batteries for transport purposes by the fact that the Drumm Battery-Driven Train, invented a short time ago, has been operating successfully for the last two years. Another train has recently been built and is undergoing a series of tests on the Dublin-Greystones section of the Great Southern Railways in Ireland. It consists of two double-coach motor-driven units with a trailer unit. Each of the former weighs 85 tons, whilst the latter weigh about 38 tons, with passengers, the total weight of the train being about 208 tons. The train is driven from electric batteries carried in four boxes suspended from the under frames of the coaches. These batteries are charged at stations by means of transformers and mercury arc rectifiers. Current at 500 volts is supplied to two 200 h.p. motors fitted to each axle of the centre bogie. The Drumm battery is an alkaline battery, the electrolyte of which consists of caustic potash solution. There are 272 cells in each motor-coach unit, the total weight of the battery being 33 tons and its capacity 600 ampere-hours.

I see that Dr. Alexander Canning has invented the Psycho-stethokyrtographmanometer ! We should expect an instrument with such a formidable name to be able to accomplish something great, and such actually is claimed for the new invention. It is, indeed, nothing less than a lie detector, and indicates whether a patient's replies to questions are true or not ! It " works " by means of rubber tubes that are attached to a delicate piece of mechanism, to which they transmit minute movements of a patient's body. These movements are recorded on a graph on a strip of paper. From the tests already made it would seem that the machine has some amusing and amazing possibilities, especially if a portable model could be brought out and introduced into daily life, in which case the old proverb " Honesty is the best policy " would undoubtedly become a universal motto. We can quite imagine that it would become a standard equipment of every schoolroom, and fishermen and other sportsmen would have to be more truthful when recounting their deeds of prowess !

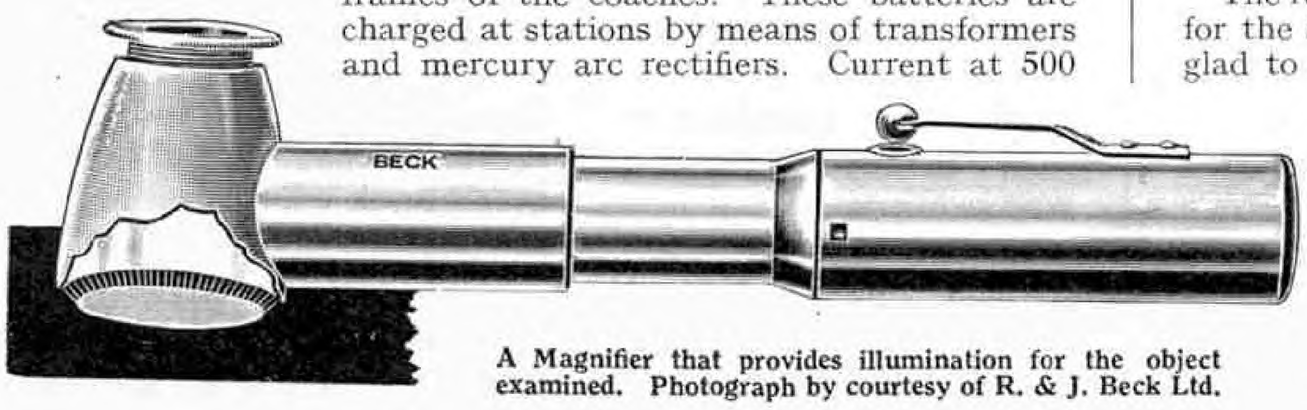
Diving Suits for Use at Depths of Half a Mile

A new diving gear that has special advantages for deep-sea diving is being examined by the Admiralty at Whale Island, Portsmouth. This device is one of the steel cylinder type (frequently mentioned in the *"M.M."*), in which the old idea of pumping air down a tube is done away with, the diver obtaining his air supply from an oxygen cylinder. Diving suits of this type were used by the " *Artiglio* " in the Bay of Biscay, during the recent successful attempts to recover the " *Egypt's* " sunken treasure. It is claimed that with the new Tritonia diving gear a man can be lowered to depths of over half a mile, the only connection with the surface necessary being a hoisting cable and a telephone cable.

In the old-fashioned meat dishes there used to be special little run-ways down the length of the dish, and a depression at the end, to collect the gravy that ran from the joint. It would be a very good thing if someone would re-introduce these devices in the modern dishes. More particularly, I wonder why someone has not invented a dinner plate with two depressions in the rim for salt and mustard ? It seems to me that this would be a most useful invention, and one that has long been called for.

I am constantly receiving proof that the ingenuity of inventors seems to be unbounded. It would scarcely be thought that such a common object as a pen nib is capable of improvement, but recently a new nib has been introduced that makes it unnecessary to dip into the ink pot. It is specially designed to hold a very large quantity of ink, but this flows through it as steadily as from an ordinary pen nib and there is little risk of blotting. It is made of hardened and tempered stainless steel and lasts much longer than the ordinary pen nib.

The recent International Exhibition of Inventions was remarkable for the immense range of the interesting devices shown and I was glad to see that many improvements in the domestic sphere were displayed, for nothing is more irritating than the failure of some little thing in every day use. I noticed a self-adjusting cover designed to keep dust and disease germs out of milk bottles, jam jars and other vessels in which food is stored ; a stair carpet fastening of original design ; and metal runners that include a device to prevent blinds mounted on them from blowing about. I hope to deal more fully with other exhibits in a further article.



A Magnifier that provides illumination for the object examined. Photograph by courtesy of R. & J. Beck Ltd.



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches or use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Famous Australian Bridge

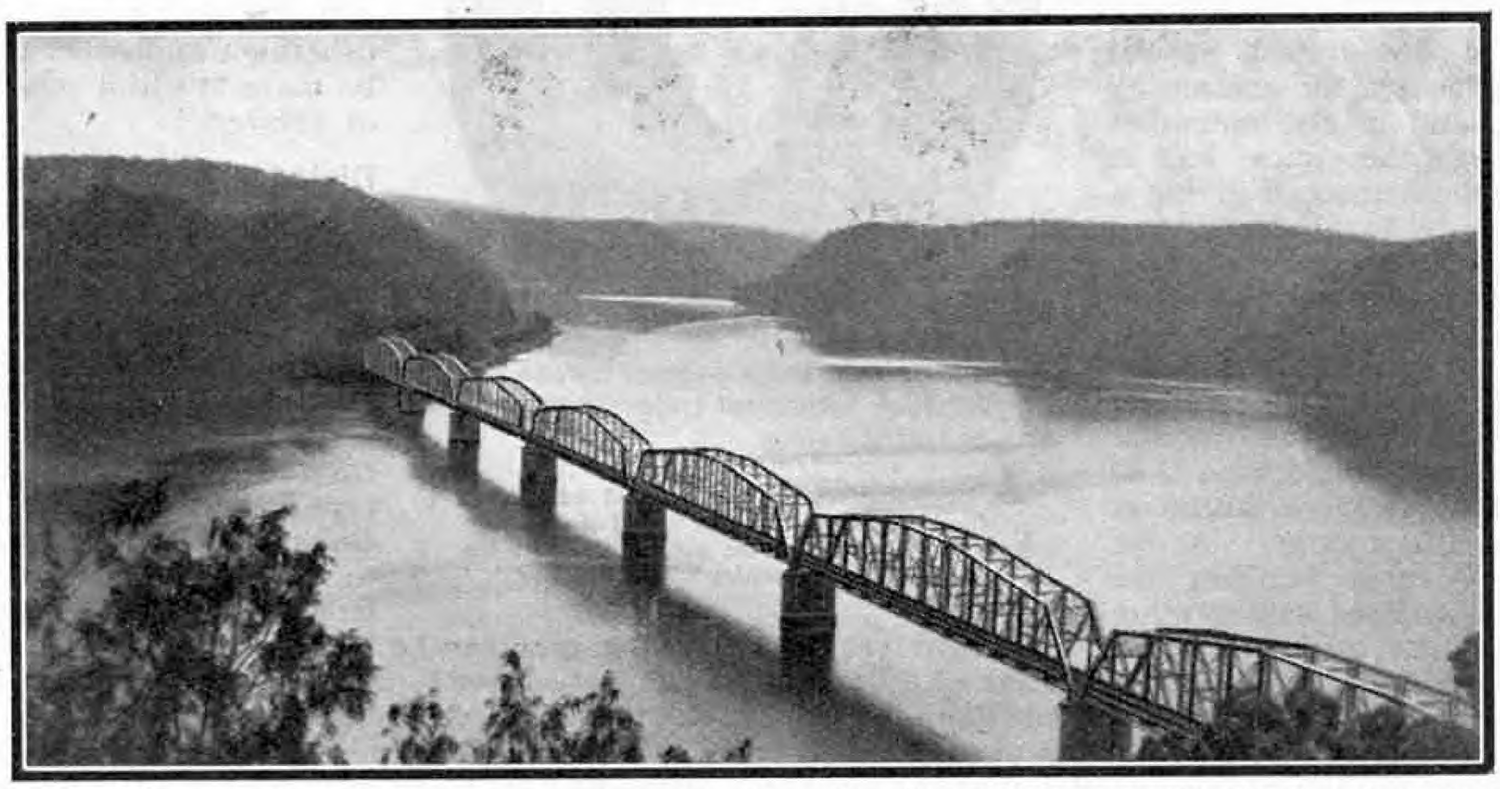
Until the completion of the great arch spanning Sydney Harbour, the largest bridge in Australia was the double-track railway structure across the Hawkesbury River, shown in the accompanying photograph. The Hawkesbury River is about 30 miles north of Sydney, and on account of the beauty of its surroundings is known as " The Australian Rhine." It is very deep and wide, and was a formidable barrier to the linking by rail of Sydney and Newcastle, the second city of New South Wales, when this task was begun about 50 years ago.

When the railway from Sydney reached the river, the line was built along steep slopes until it came opposite Long Island, which lies off the south bank. A causeway was built between the south bank and Long Island, and a tunnel driven under the high ground of the island to the edge of the main channel, 3,000 ft. in width. In the meantime plans for the construction of a great bridge to span this obstacle had been completed. The builders took possession of Dangar Island, a short distance down the river, and there erected workshops and huts for stores. Accommodation also had to be provided for the workmen, for the surrounding country had not then been settled, and even to-day is still wild, as may be seen from the accompanying photograph, only week-end cottages and small farms fringing the banks of the river.

The bridge to be built was to consist of seven spans, each 416 ft. in length, making a total length of 2,912 ft. This necessitated the erection of six piers on the bed of the river. Caissons were sunk until solid foundations were reached, and the steel tubes were then filled with concrete to form bases for the masonry work that eventually rose above water level. The foundations of the piers are remarkably deep. With one exception, these are at depths of more than 100 ft., and they form what is claimed to be the deepest group of bridge foundations in the world. The bottom of No. 6 Pier is actually 202 ft. below water level.

The spans were erected on Dangar Island, where they were built on tall barges. Each in turn was floated between the piers when these were ready, and gradually lowered into position on the ebb tide, the supporting barges being partially sunk to complete the movement. There were no disastrous mishaps, although the barge carrying one span broke loose from its moorings in stormy weather.

M. MORGAN (N.S.W.)



The double track railway bridge across the Hawkesbury River, New South Wales. This structure is an important link in the line joining Sydney and Newcastle. Photograph by M. Morgan, Cremorne, N.S.W.

Rat-Bats!

While staying in Jamaica I obtained permission from the owner of a plantation to explore a cave on his land, and a negro was sent with me to make bamboo torches and act as guide. Entrance to the cave was difficult, for the rocks over which we passed were very slippery. Our efforts were well rewarded, however, for we found ourselves in a gigantic tunnel that in many places was more than 100 ft. in height.

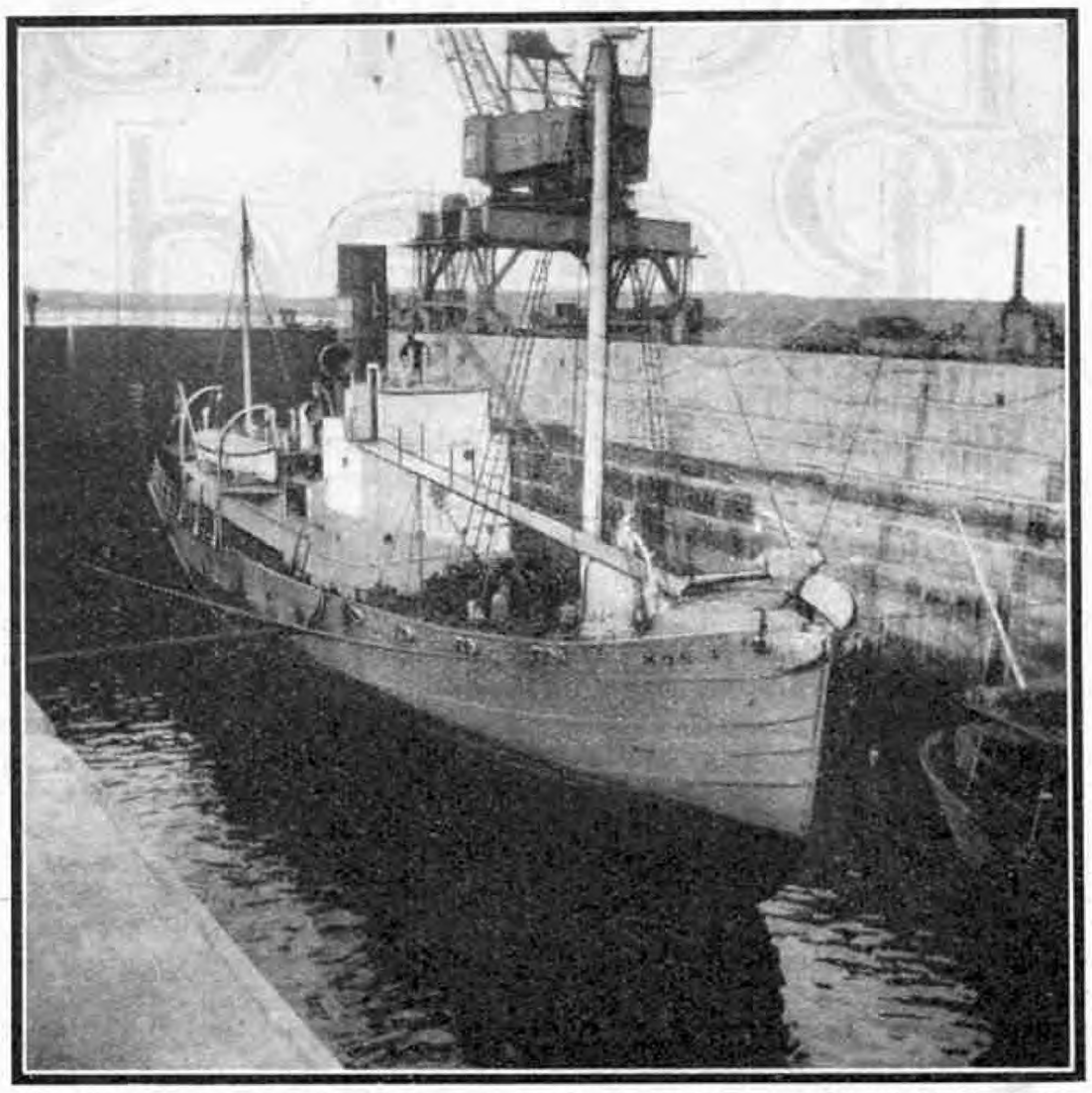
After making our way over boulders and pools of water for twenty minutes, we were startled by shrill squeals and loud whirring noises overhead. Looking up, we were unpleasantly surprised to see flying above us thousands of huge bats, called rat-bats by my guide. Apparently we had disturbed the afternoon siesta of these creatures and many of them flew repeatedly round our heads and shoulders as if threatening to attack us.

We decided to return hurriedly, but the floor of the cave was so slippery that my guide fell back while climbing the steep ascent to the entrance. I tried to save him, but also slipped and we both rolled down into the cave again. When we eventually reached the entrance, we were almost exhausted. H. FROBISHER (Swaffham).

A Whale Catcher at Falmouth

During a visit to Falmouth Docks I was able to take a photograph of a whale catcher, an interesting little vessel about the size of a Thames tug, that is employed in searching for whales and killing them by means of a harpoon gun carried on a platform in the bows. Unfortunately the gun was protected by a canvas cover at the time, but the photograph shows the gangway from the bridge that enables the harpooner to reach the weapon quickly when a whale is sighted.

The harpoon weighs about 1½ cwt., and in its head carries a charge of explosive that kills the whale immediately on striking it. When one of these creatures has been captured in this manner, it is inflated with compressed air to keep it afloat and marked with a flag while the hunt continues. Then the catches are towed to the mother ship, on to the deck of which they are hauled through an opening at water level in the stern. The larger vessel is really a gigantic floating factory for the extraction of whale oil and other valuable products, and a whaling fleet consists of a factory vessel and a flotilla of whale catchers. A cruise usually occupies about two years. S. A. J. PARSONS (Carshalton).



The "Kos V," the whale catcher described in the article on this page, in the docks of Falmouth. Photograph by S. A. J. Parsons, Carshalton.

A Hungarian Light Railway

While taking part in the World Scout Jamboree in Hungary last August, I was greatly interested in the many narrow gauge railways I saw. Railways of this type seem to be fairly common in Hungary, where they are built to connect outlying villages with the State Railways that run through the larger towns and cities.

I had the pleasure of a trip on one of these railways when I and other Scout visitors were taken from Kecskemet for an interesting trip across the wide and fertile plains of Central Hungary. The rails of this line are of the Vignoles or flat-bottomed type used on the Continent and also in the United States and Canada. The sleepers are cut from local timber, and apparently are treated in a manner similar to that adopted in Great Britain. They are not all straight, the chief requirement being that they should be flat; and on them are plates, each having four holes through which spikes are driven to fix them to the sleepers. These spikes have heads shaped to grip the rail bottom, and I noticed that only two spikes are employed for each plate, although four holes are provided. A curious feature of the line was the absence of curved rails at certain bends of large radius, each rail being laid to make a small angle with those on each side of it.



A tank engine on a Hungarian light railway. Photograph by J. L. Ritchie, Leeds.

The locomotive stock of the Kecskemet line at the time of my visit consisted of two small tank locomotives that seemed to be rather old and out of date. One of these is shown in the accompanying photograph, taken from the train in which I travelled. Needless to say, not all the railways are provided with engines of this kind, and a similar narrow gauge line at Szeged, Hungary's second largest city, boasts eight modern Diesel-electric locomotives, on one of which I was privileged to ride.

The train of the Kecskemet line consisted of two coaches, one of which was second-class and the other third-class. The seats in the third-class coach were of hard board, the common practice in European countries, but those in the second-class were upholstered in green plush. Both coaches had only four wheels, and were not too well sprung, judged by British standards. The absence of raised platforms seemed strange to me. The space between the tracks is filled in flush with the rails, but passengers may wander across the line as they choose.

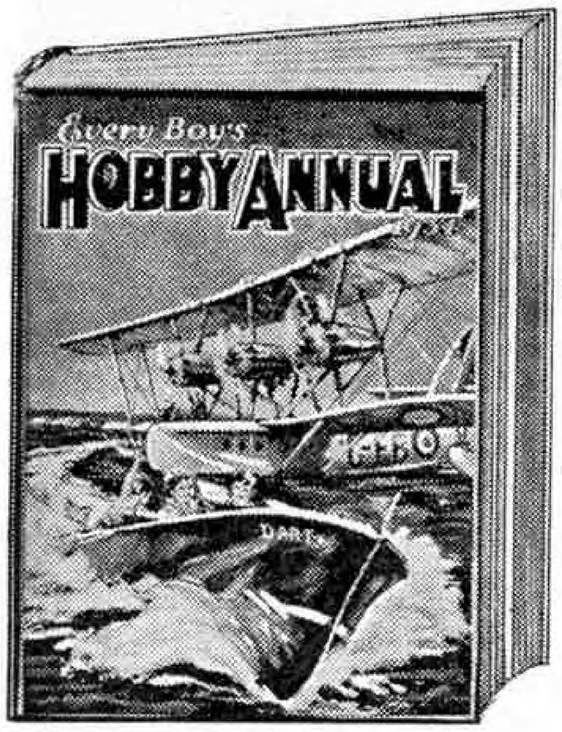
J. L. RITCHIE (Leeds).

On the Footplate of a "Garratt"

During a holiday spent at Chesterfield I visited the engine sheds at Hasland, and there was delighted to see two of the giant 2-6-0 : 0-6-2 "Garratt" locomotives employed on the Midland Section of the L.M.S.R. One of these had just come in from its main line duties and I was invited to enter the cab, where the fireman was demonstrating the working of the Beyer-Peacock revolving coal bunker with which it is fitted. A nut in the front of the cab was turned by means of a large spanner in order to admit steam to the small donkey engine that actuates the bunker. The fireman then pulled out a locking rod and tugged a lever towards him, and the bunker began to revolve, to the crashing accompaniment of moving coal.

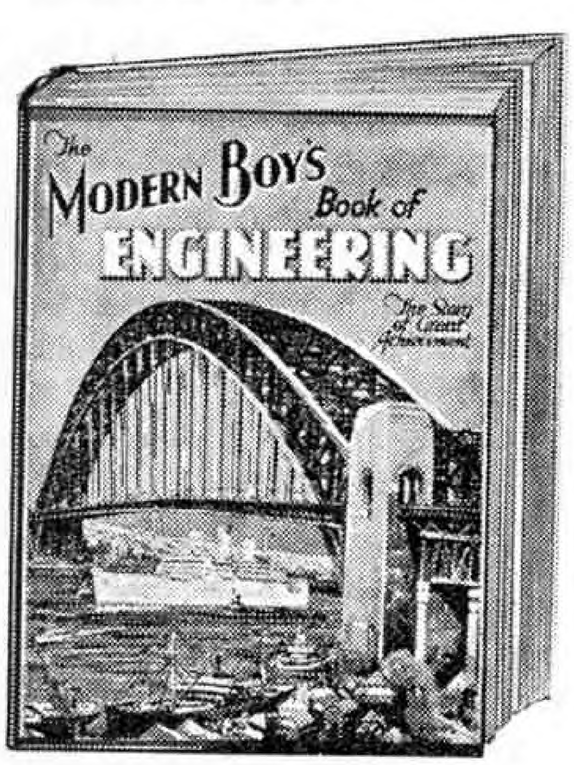
The fireman then turned his attention to the firebox, lowering the drop bars and breaking up and removing great masses of clinker before clearing the ash pan by means of a jet of water. I stayed in the cab while the engine took in coal and water, and glided silently to a position alongside the second of the locomotives of this type in the shed. K. GORE (Leeds).



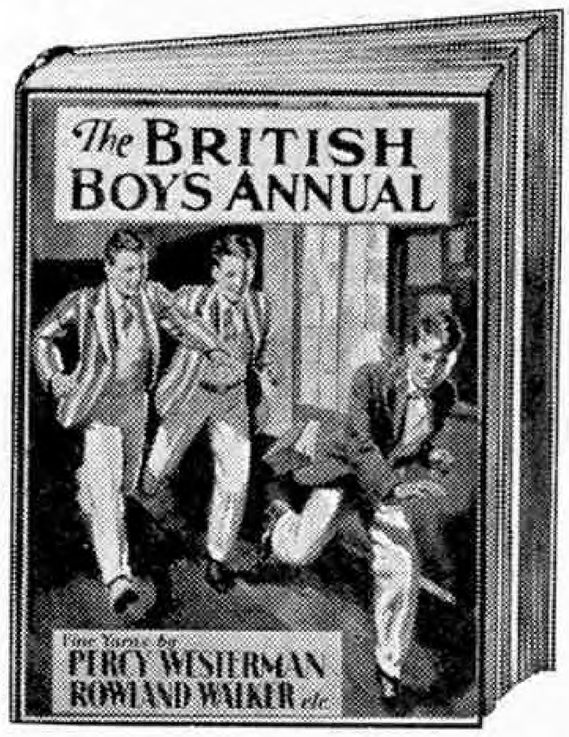


Stories of Mystery and Adventure

"*Mystery Men O'War*," by G. J. Garner (Nelson & Sons, Ltd., 3/6), is one of the best stories we have read for some time. It is a wartime story, and describes the remarkable adventures of two apprentices on a cargo vessel, which is torpedoed and sunk. The boys, along with a few of the crew, are rescued, but find themselves in a ship about which there is something very mysterious. To explain the mystery would spoil the book for readers, but it can safely be said that the subsequent happenings to the apprentices, which include a period as prisoners in a German submarine, provide thrills enough for anybody. In "*Scouts of the Sky*," by E. Keble Chatterton (Warne & Co. Ltd., 2/–), the author gives us another exciting story in which his now familiar heroes Bob Crane and Wilmer Loring play a prominent part. This is a yarn of high adventure by sea and air, concerning hidden treasure on an uninhabited island. The story starts with the theft of a plan of the island, and before it ends we are given ample excitement in a Diesel-engined whale catcher, and in aeroplanes from an aircraft carrier. "*Black Pete*," by T. H. Scott (Warne, 1/6), is a typical cannibal island story. Two survivors from an English ship reach the island, and find themselves in serious danger from the cannibals on one hand, and Black Pete and his band of cutthroats, who are in search of a hidden treasure of rubies, on the other. After many exciting adventures the castaways seize Black Pete's ship and make their escape. "*The Motor Car Mystery*," by T. C. Bridges (Warne, 2/–), is a short but exciting moorland story concerning the attempts of an unscrupulous adventurer to obtain possession of an abandoned mine that he knows to possess hidden wealth. The author takes us breathlessly along through a series of thefts of a pearl necklace and a motor car, up to an exciting finish in which the villain and his accomplice meet their deserts.



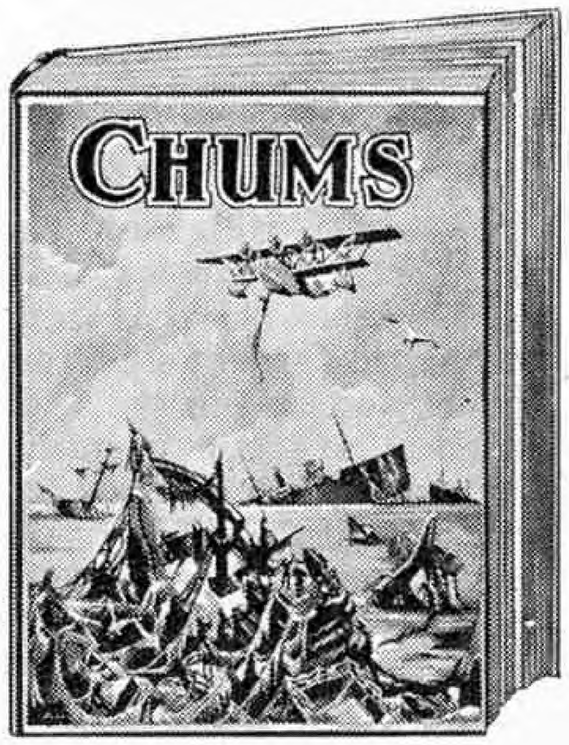
"*Fighting Through*," by Sheikh Ahmed Abdullah (Warne, 2/6), consists of a series of episodes in the life of a Pathan chieftain in Afghanistan and Central Asia. The episodes themselves are exciting, but the material by which they are connected is sometimes rather dull, in spite of the excellent descriptions of the country and the people. "*The Sea Harvesters*," by Walter Wood (Warne, 3/6), is a well-written story of the North Sea. Wilf Sutton, the hero of the story, while fishing in a ramshackle boat of his own making, loses his paddle and drifts out to sea into dense fog. He is rescued by a trawler on its way to join the fishing fleet, and he decides to become a fisherman. The trawler in which he is working is run down in wild weather by a mysterious vessel, which Wilf and one of the crew manage to scramble aboard before the trawler goes down. From this point the action of the story proceeds rapidly with one excitement after another, and at the end one's only regret is that Wilf decides to leave the sea for a shore life! In "*Dick of the Secret Service*" (R.T.S. 2/–), Robert Harding gives us one of his best stories, dealing with secret service on the Indian North West frontier. The author's description of life in this wild region is based upon personal experience, and is therefore full of interest. The adventures of Dick Renshaw and the giant Evan King, a member of the Indian Secret Service, are exciting from start to finish, and it can safely be said that there is not a dull moment in the book. From Robert Harding comes also "*The Keys of Freedom*" (R.T.S., 2/6), a series of eight well-written stories of adventure in the East.



School Stories

(F. Warne & Co. Ltd.)

"*Wireless Watson* (2/–), by T. H. Scott, is an excellent story with plenty of thrills, centred round the activities of two wireless enthusiasts. How the pluck and loyalty of the fag of one of them almost results in disaster is splendidly told. "*Pole For Cock House*" (2/6), by A. L. Haydon, fully maintains its author's reputation. The new school captain is faced with serious difficulties as the result of his attempt to stamp out betting among a small group led by the footer captain. A series of mysterious incidents take place, including an attack on a master returning to the school at night. The school captain himself falls under suspicion, and matters are only cleared up by the confession of a boy who becomes terror-stricken during an outbreak of fire. In "*Buttle Butts In*" (3/6), by Hylton Cleaver, the author takes as the basis of his plot the impossible situation of a boy settling himself down in a school at which he has not been entered, and makes the best of it, although the result is not altogether satisfactory. There is plenty of excitement in the book, however, and an element of mystery that helps matters considerably. "*Captains of Duke's*" (2/–), by the same author, consists of nine well-written and varied stories, all dealing with the same school but at different periods. "*Carruthers of Colnhurst*" (3/6), shows F. A. M. Webster at his best. The theme is not unusual—that of a boy making good against all kinds of difficulties—but the story carries one along by its breezy style. The book is full of the real school atmosphere.





Annuals

(R.T.S.)

The 55th volume of "*The Boy's Own Annual*" (12/6 net) seems even better than its many fine predecessors. The stories are well written, and full of adventures as exciting as any boy could desire. On the more serious side, the excellent "Behind the Scenes" series of articles is continued, and the topics dealt with in the present volume include "The Central Telegraph Office," "Navigating an Atlantic Liner," "The Royal Observatory" and "London's Sentries." The articles on Nature, stamp collecting and sports are interesting and informative, and those of the "how to make" type are well up to the standard. The coloured plates are particularly fine, and the black-and-white illustrations are numerous and good. "*The Girl's Own Annual*" (12/6 net) is only a year younger than the brother volume just mentioned, and is just as up-to-date and entertaining. The stories abound in thrilling adventures, and the many practical articles cover a wide variety of arts and crafts and of sports. The splendid coloured plates and numerous black-and-white illustrations help to make this volume a delightful gift for girls in their 'teens.

The new "*Empire Annual for Boys*" (7/6 net) is on similar lines to the previous volumes, and the stories cover adventures in all parts of the world. Excellent tales of sport and of school life are included, and the general articles are of particular interest. In the companion volume, the "*Empire Annual for Girls* (7/6 net), school stories again form the outstanding feature, and there are also many good stories of adventure. Each of these books is generously illustrated and includes four coloured plates. The latest volume of "*The School Boy's Annual*" (3/6 net) is full of jolly stories of school life, and also contains some excellent adventure yarns. "*The School Girl's Annual*" (3/6 net) is on the same lines, with stories of school, sport and adventure that will appeal to the modern schoolgirl. The volumes are well illustrated and form pleasing Christmas gifts.

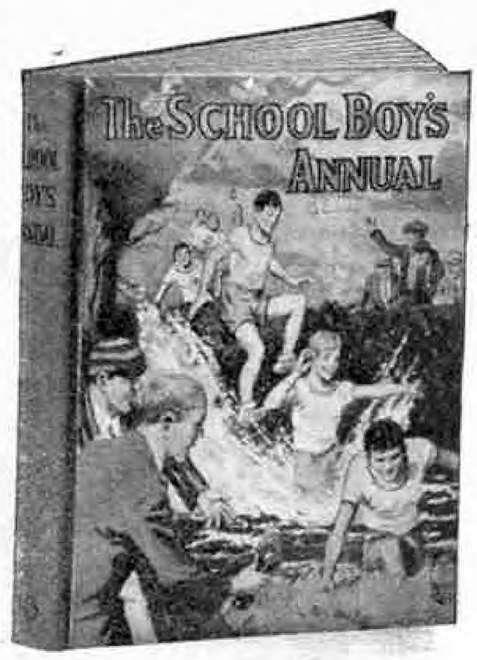
(Amalgamated Press)

The publication of a new volume of "*Chums*" (12/6 net) is always eagerly awaited, and the one just issued is a worthy successor to the many previous numbers. The 768 pages of this substantial volume contain thrilling serials by well-known writers of stories for boys, and many excellent short yarns. The general articles cover a very wide range of hobbies, including stamp collecting, wireless, nature study, and model-building. A new feature is "The Open Road," and in these pages hiking, cycling, camping and kindred subjects are discussed in a chatty style. As in previous volumes, the illustrations, and especially the pages of pictures in photogravure, are excellent.

Every boy loves exciting stories, and "*The Champion Annual for Boys*" (6/– net) is full of them. Interesting articles describe vividly the thrills of mountaineering, football and speedway riding. There are four fine coloured plates and numerous black-and-white illustrations. "*The Modern Boy's Annual*" (6/– net) touches upon the romantic side of many branches of science, engineering and sport. The wide range of subjects dealt with includes shipbuilding, wireless, film production, life in the Navy, flying, and motor racing. The many half-tone illustrations are excellent, and the volume makes a splendid gift for a boy who prefers true stories to fiction. "*Every Boy's Hobby Annual*" (6/– net) contains articles on many fascinating hobbies, and brief descriptions and simple diagrams make easy the construction of all kinds of models. In addition there are articles on railways, ships, motor cars, etc.

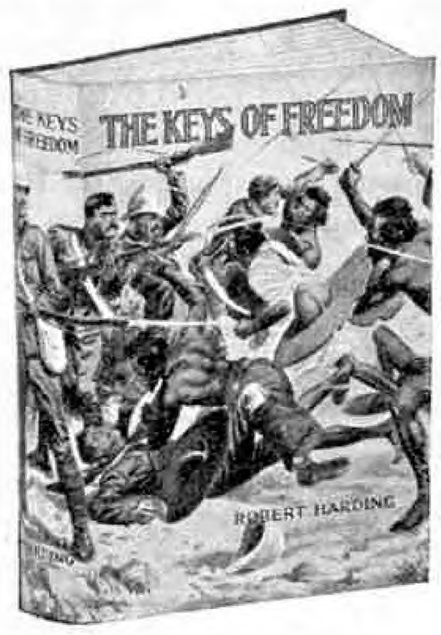


The 1934 volume of "*The Boy's Cinema Annual*" (3/6 net) follows upon the lines of previous issues, and contains stories of some of the latest outstanding films. Interesting articles take the reader behind the scenes at some of the largest film studios. The volume is plentifully illustrated, and will give great delight to boy and girl film "fans." The many good stories in "*The British Boy's Annual*" (5/– net) will satisfy the most exacting lover of thrilling adventures. The general articles cover such interesting subjects as the beginning of the lighthouse, the triumph of railway speed and the art of wrestling. The good balance between the various types of story that has always been the outstanding feature of "*The Greyfriars Holiday Annual*" is well maintained in the latest volume. The school stories enable us to renew acquaintance with the ever-youthful chums of Greyfriars School, Tom Merry & Company, of St. Jim's and with the popular Jimmy Silver and Company of Rookwood. In addition there are some excellent stories of adventure. This year the price is reduced to 5/– net.



(F. Warne & Co. Ltd.)

The stories in "*Warne's Adventure Book for Boys*" (2/6 net) are so exciting that the fortunate possessor of this book will find it difficult to put it down before he reaches the last page. In the companion volume, "*Warne's Pleasure Book for Boys*" (2/6 net), the yarns contain their full share of thrills, and there is also an article on how to construct the smallest glider in the world. Both books are well illustrated and contain coloured plates.

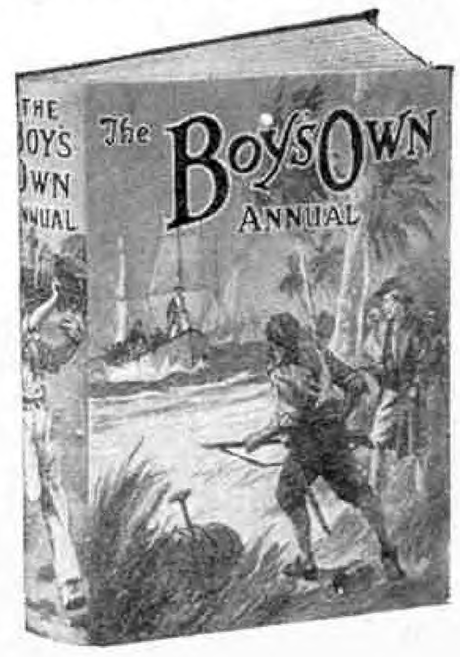


Books of General Interest

The "*Modern Boy's Book of Engineering*" (Amalgamated Press, 7/6 net) will appeal greatly to all readers of the "*M.M.*" on account of its enthralling stories of great engineering achievements. The building of the Tower Bridge, London, and the Sydney Harbour bridge, the drainage of the Zuyder Zee, Holland, and the construction of the Panama and Suez canals are among the many great projects described. Excellent articles of the "behind the scenes" type deal with the running of a railway station, life on the footplate of a locomotive, how a great liner is built, the working of a modern ironworks, etc. The interest of the book is increased by numerous half-tone illustrations and a fine series of coloured plates.

Three recent additions to "The Nelsonian Library" (T. Nelson and Sons Ltd., 3/6 each) maintain the high character set by the earlier volumes in this excellent series. J. Lennox Kerr, the author of "*The Young Steamship Officer*," is himself a steamship officer who started his sea career at the age of 17. In an extremely varied series of chapters he describes the fascinating details about ships of to-day as only a practical sailor could do, and among other things he explains the intricacies of a steamship's rigging, the ranks and ratings of her crew, the mysteries of watches and of bells, and how ships talk to one another. There is an interesting chapter describing a dozen fascinating games centred around ships and seamanship, and the book concludes with the thrilling story of the author's first voyage. The book is well illustrated, and is one of the best of its kind that we have come across. "*Tank Warfare*," by F. Mitchell, M.C., describes the part played by the Tanks in the Great War. The author himself served in the Tank Corps, and was in command of the first English tank which met a German tank in single combat. The exciting and interesting material in the book is drawn largely from his personal experience. The numerous illustrations are good, and there is an interesting glossary of Tank terms.

"*Daily Danger*," by Stuart Chesmore, deals with unusual methods of making a living, in which danger is always present. His topics range from shark fishing and pearl diving to searching in wild regions for rare flowers. There are also thrilling accounts of salvage work on wrecks, fighting great forest fires, and carrying mails by air. The book is written in a racy manner, and the illustrations are excellent.



Greater Realism and More Models
with the
Meccano Special Aeroplane Constructor Outfits

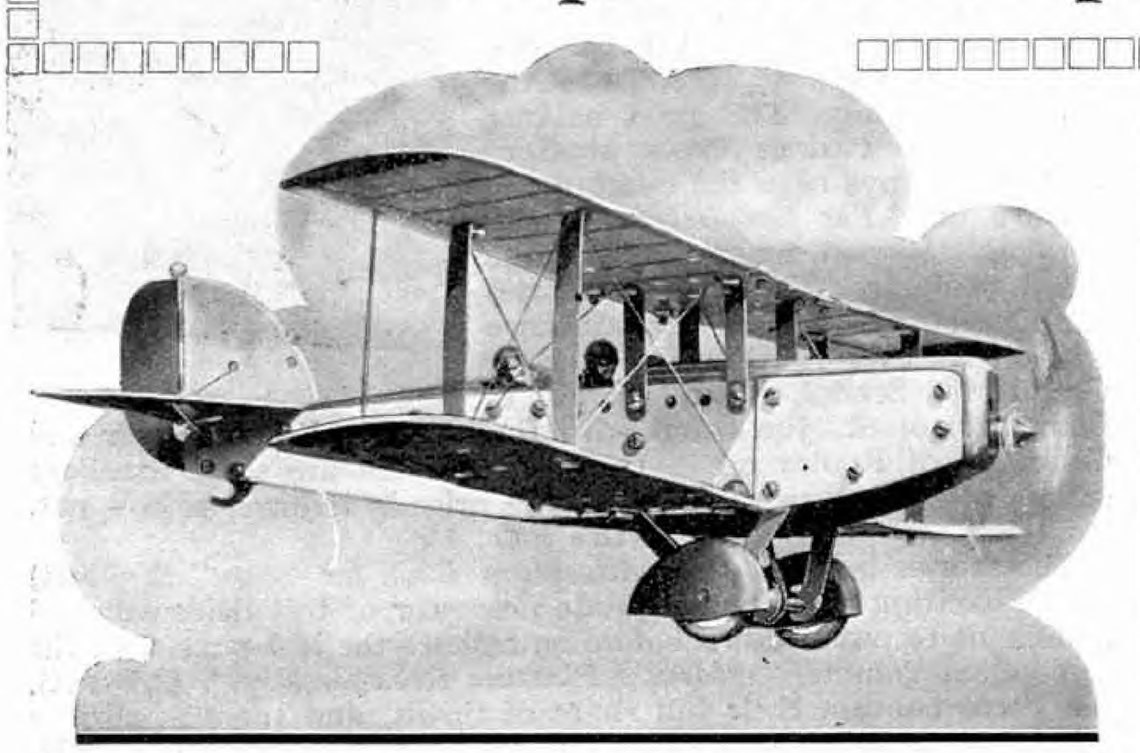


Fig. 1. Two-Seater Light Biplane.

THE Meccano Aeroplane Constructor Outfits were received with immediate enthusiasm by all model builders interested in aviation, and an even warmer welcome is assured for two new Outfits that have just been introduced, and which may be described as super editions of the Outfits Nos. 1 and 2. They contain many entirely new parts, and great improvements have been made in the existing parts. The new Outfits, which are known as Special Aeroplane Constructor Outfits Nos. 1 and 2, enable models to be built with far greater realism than was previously possible, and a large number of different models can be built with each Outfit. The Manual of Instructions illustrates 20 realistic models built with a No. 1 Outfit, and an additional 24 are shown for the No. 2 Outfit. These by no means limit the possibilities of the Outfits, and much fun can be had from designing new models to individual tastes.

Four models built with the Special Outfits are illustrated here, and they show clearly the special features that are exclusive to the new Outfits. The fuselage is of improved design, and the rounded Front and Underside Sections, totally enclosing the underneath portion, greatly enhance the appearance of the finished model. This feature is shown to advantage in flying boats and amphibians, the hulls of which can be made to resemble very closely those of actual machines of these types.

Representations of cabin windows and doors are transferred on the Fuselage Side Middle Sections, which may be bolted in position with the windows facing inward or outward according to the type of machine under construction. For open cockpit machines the windows face inward, and also in some cabin machines of the type that usually carry three or four persons. The pilot and passengers are seated in the same cabin, which is represented by the Cabin Head, bolted in position over the fuselage.

Fig. 4 represents a larger machine with accommodation for eight or ten passengers. In this case the passengers are seated inside the fuselage, which is provided with windows ; and there is room for two pilots in a separate cabin represented in the model by the Cabin Head. This model is a monoplane of the low-wing type that is now becoming very popular. Some idea of the respective sizes of a light cabin machine and a large commercial monoplane may be gained from the fact that the four-seater Blackburn " Segrave " has a span of 39 ft. 6 in., while the Junkers G.31 twelve-passenger low-wing monoplane is 99 ft. 6 in. in span.

Single or two-seater open cockpit machines can be constructed, the two-seater machine being made by using a different Rear Section for the top of the fuselage, this piece being provided with the second cockpit. Both cockpits may be fitted with Pilots, as is shown in the light biplane model illustrated in Fig. 1. Machines such as this are used mostly for pleasure flying, and are also useful for training purposes at aero clubs. When used for the latter purpose they are fitted with dual control so that the beginner can follow all the movements made by his instructor, and later when he takes control himself, the instructor is able to correct any false movements.

In biplane models the wings may be mounted one directly above the other, that is unstaggered, or staggered at two different angles, according to the type of Interplane Struts employed. In the models illustrated in Figs. 1 and 2 the Straight Struts are used, and also the straight Centre Section Struts. The biplane in Fig. 3 has Staggered Struts. The upper and lower Main Planes

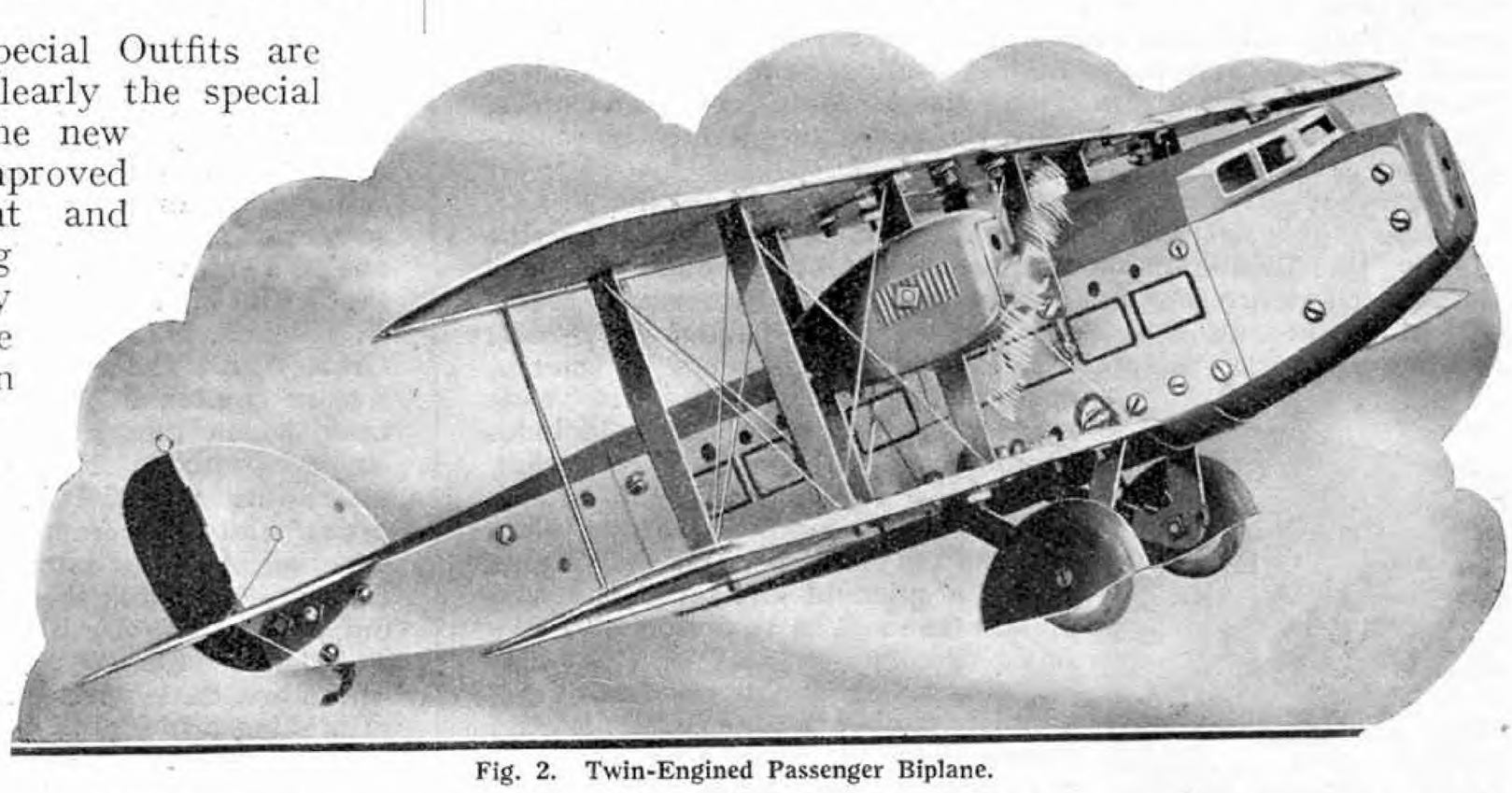


Fig. 2. Twin-Engined Passenger Biplane.

are provided with ailerons that can be connected together by Aileron Connecting Wires supplied for this purpose. The Tail Planes are fitted with elevators connected by an Elevator Coupling Piece, which fits through a hole cut in the Rudder and Fin. The Rudder is hinged on the Fin and may be removed by withdrawing

the Pivot Pin. Thus the striped Military Rudder may be substituted for the plain one if an R.A.F. machine is under construction, and the Identification Discs are bolted to the Main Planes and the Fuselage Sides.

Three main types of engines are in use on modern aircraft. These are the radial air-cooled engine, the in-line type of air-cooled engine, and the water-cooled unit in which the cylinders are also arranged in line. If the model under construction represents an aeroplane with the in-line type of engine mounted in the nose of the fuselage, the air-screw is placed immediately in front of the Fuselage Front as in Fig. 1. The model in Fig. 4 is fitted with a Radial Air-cooled Engine provided with Townend Ring. This is detachable, so that machines not fitted with the ring may be modelled true to type. Streamlined Nacelles are supplied for mounting behind the radial engines when they are fitted on the wings, or Struts of the machine as in Fig. 3. The Nacelles are made in three sections, two sides and a front; and in Fig. 3 a side piece is mounted on each side of the Pierced Interplane Struts. They may be mounted on the wings of monoplane models by fitting one side piece above and the other below the Main Plane, or on the special Nacelle Struts for fixing above the wings. The engines shown on the model air liner in Fig. 2 can be used to represent a water-cooled power unit or the in-line type of air-cooled engine. They may be mounted in the manner shown or may be bolted directly to the wing, or carried on Centre Section Struts above the upper wing.

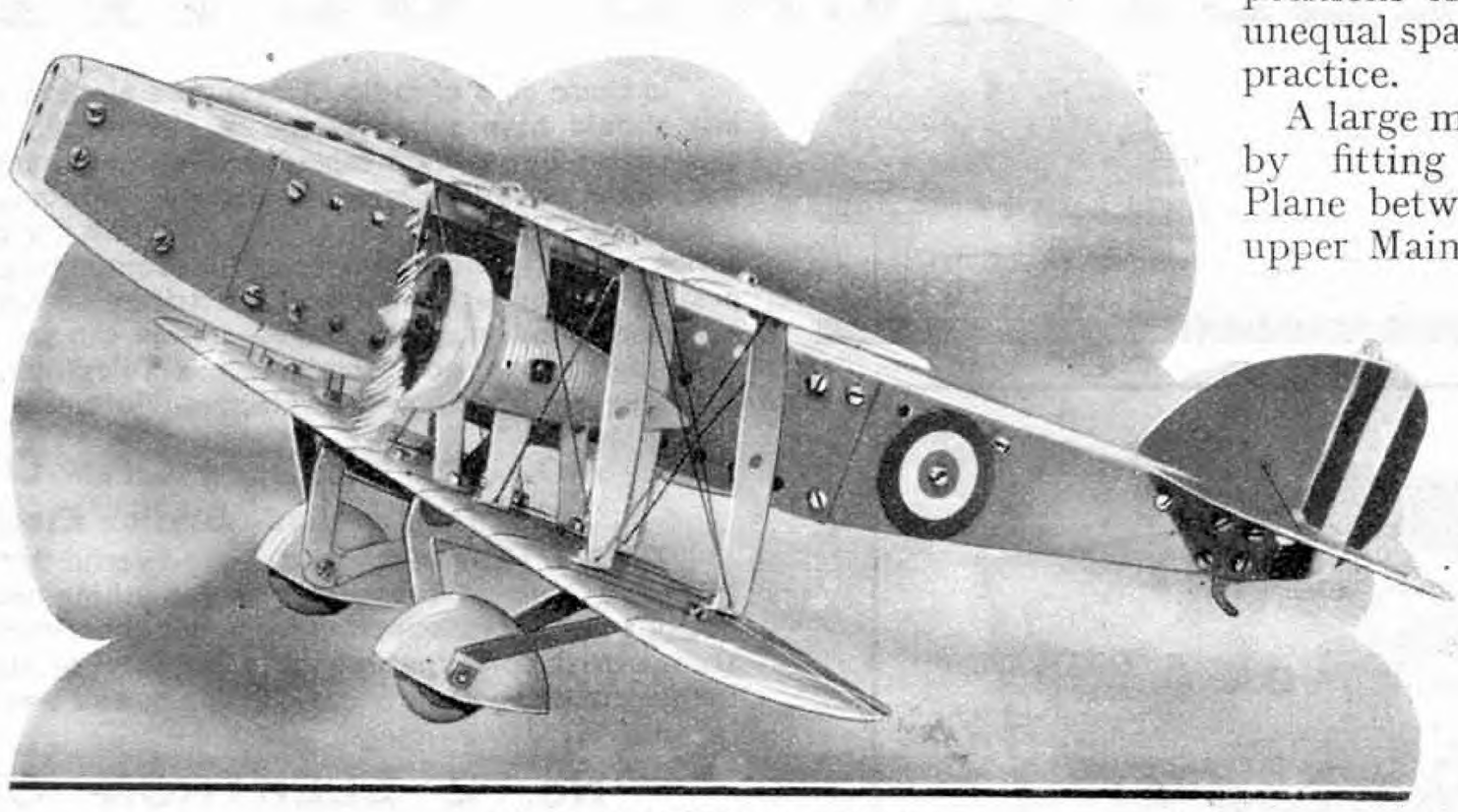


Fig. 3. Raised Fuselage Biplane.

The tail unit or empennage of a model flying boat differs from that of a landplane or float seaplane in that the Tail Planes with elevators are mounted higher up on the Fin. Bracing may be added by bolting Float and Centre Section Struts between the fuselage and the Tail Planes. The Elevator Coupling Piece cannot be used when the tail unit is built in this manner.

Several amphibians are illustrated in the Instruction Manual. Machines of this type can alight on either land or water. When used as a flying boat the landing gear is raised clear of the water, but can be lowered while the machine is in flight if it is desired to make a landing on an aerodrome. This arrangement has obvious advantages, and such machines are particularly useful in difficult country such as is met with in Canada, where the lakes afford a suitable landing when no level ground is available.

Biplanes and monoplanes of different wing spans can be made, the lengths of span being varied by the use of Centre Section and Extension Planes. A small model biplane, as illustrated in Fig. 1, is made by bolting the lower Main Planes directly to the fuselage by means of Angle Brackets, and fitting an Extension Plane between the inner ends of the upper Main Planes to allow for the width of the fuselage. The upper and lower planes of this model are of equal span, that is, the distance from wing tip to wing tip is the same in each case. To build an unequal span machine, the Centre Section Plane is used instead of the Extension Plane, so that the upper wings are longer than the lower ones. With such an arrangement it is necessary to use the Angled Struts that allow for the difference in the positions of the holes at the ends of the wings, and also take up the positions of the Struts fitted to unequal span machines in actual practice.

A large model biplane is made by fitting a Centre Section Plane between the ends of the upper Main Planes and spacing the lower Planes from the fuselage by Extension Planes. This enables a two-bay machine to be built by using two sets of Interplane Struts at each side of the fuselage as exemplified in Fig. 2. Sesquiplanes, or "one-and-a-half wing" type of aircraft, can be made by using the large Main Planes in conjunction with the small lower Planes.

Among the models illustrated in the Manual of Instructions are four that are of particular interest as they represent unusual types that are rarely met with in actual practice. One of these is a Cantilever Biplane, on which there are no struts or bracing wires between upper and lower wings. The lower wings are set much farther back than usual, and the model closely follows the lines of the Darmstadt D.22. Another unusual model is the Single-Float Amphibian. The only actual machine of this type in England is the Short "Mussel."

A machine that differs considerably from usual practice is the Focke-Wulf "Ente," which flies with the small tail plane in front and the large main plane at the rear, thus giving the appearance of flying tail-first. A realistic

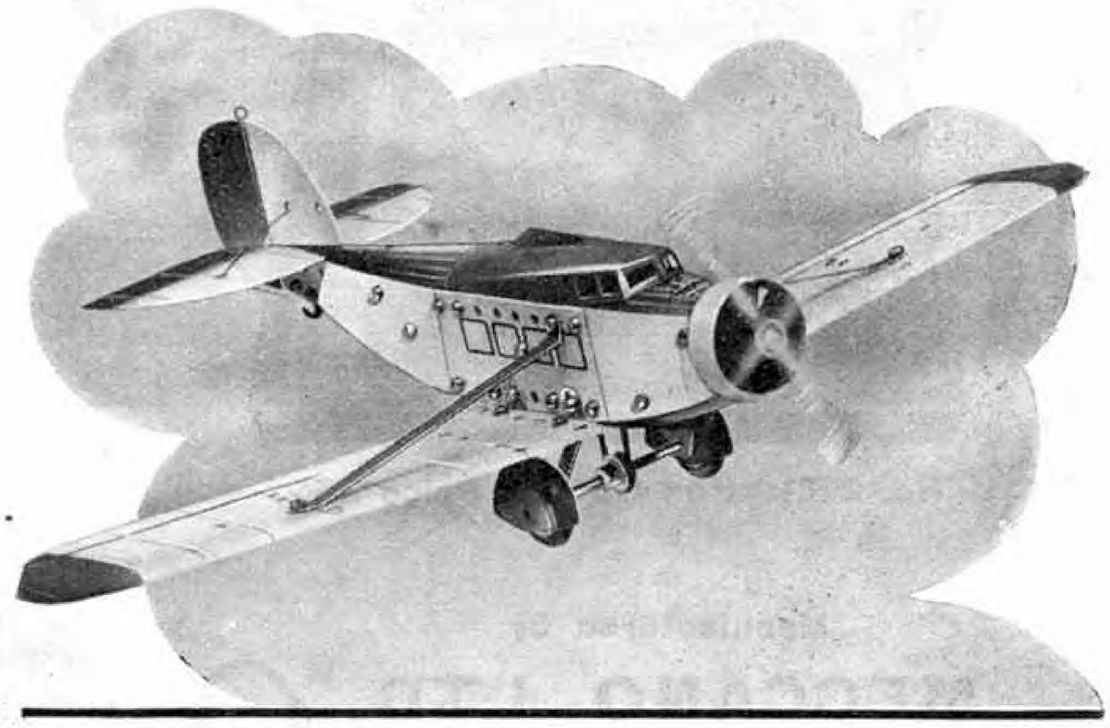
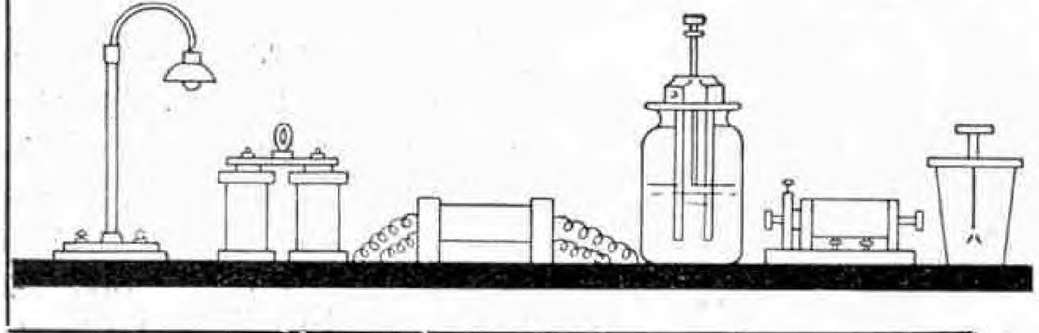


Fig. 4. Commercial Low Wing Monoplane.

model of this type of aeroplane is illustrated among the No. 2 Outfit models. The model biplane illustrated above in which the fuselage is bolted to the upper plane instead of the lower one, as is usually the case, represents a type that is not met with very often.

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In these days of radio, X-rays, and electric trams and trains, every boy should have a knowledge of electricity. The only way to gain this knowledge is by means of experiments, and the Elektron Outfits have been produced specially for this purpose.

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No. 1 Elektron Outfit Price 8/6

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An Accessory Outfit is also available that converts a No. 1 Elektron Outfit into a No. 2.

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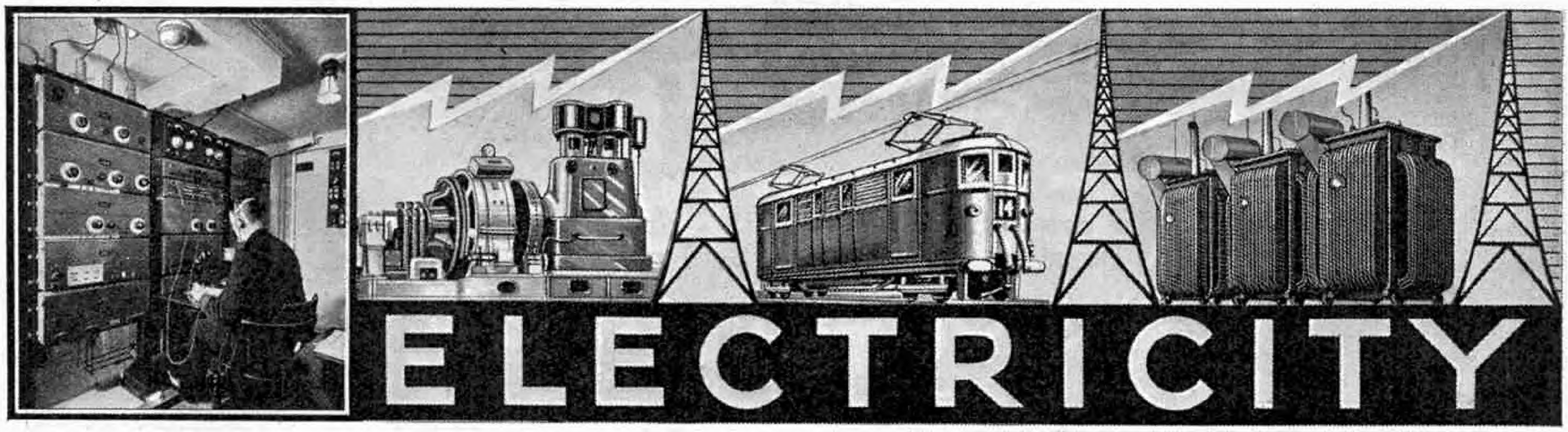
No. 2 Elektron Outfit Price 25/-



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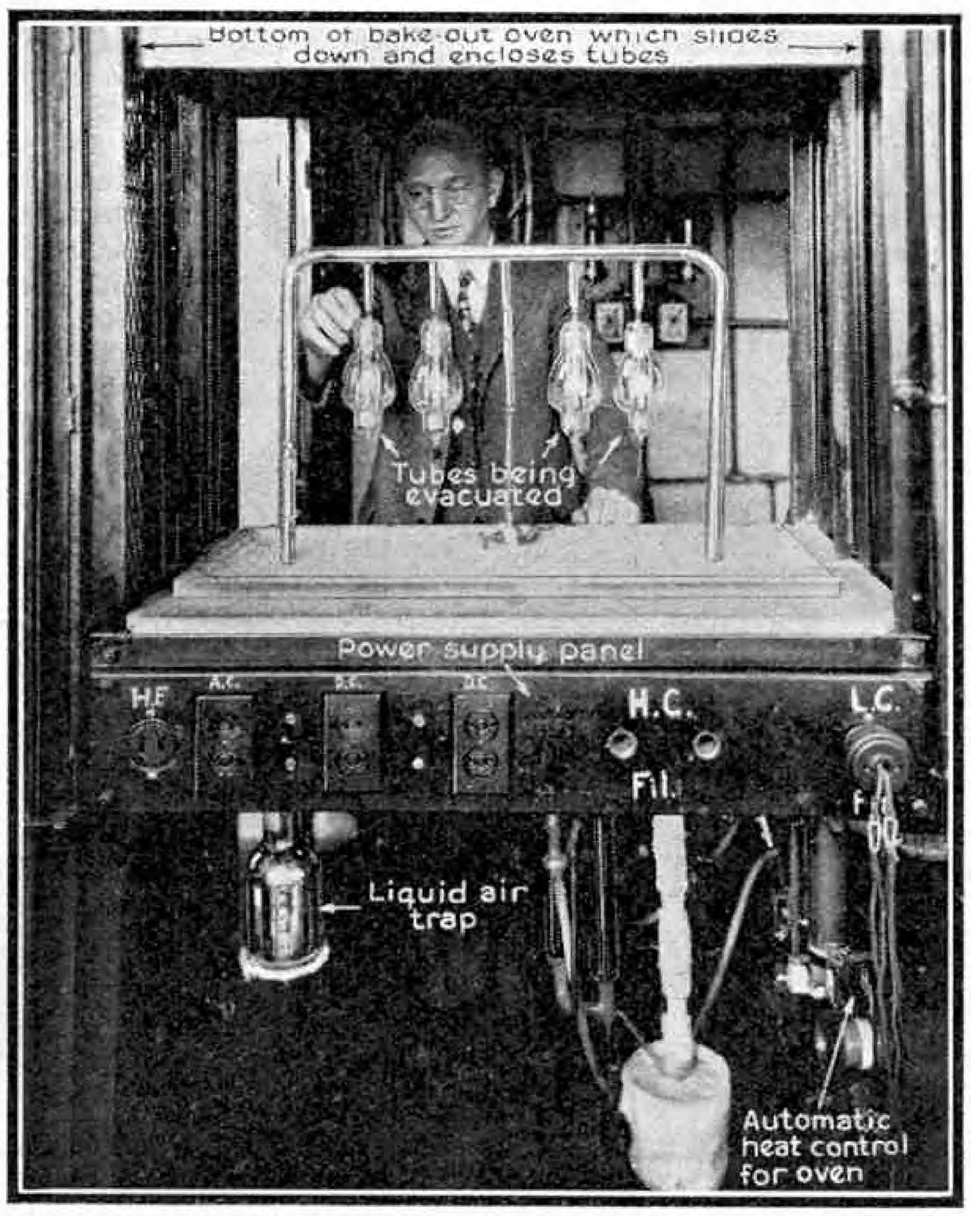


SOMETHING OUT OF NOTHING!

EVER since Swan in this country, and Edison in America, invented the electric light bulb, the vacuum tube has become more and more important in electricity. These pioneers obtained light by passing an electric current through a carbon filament that became red hot, and would have burned up in a few seconds if it had been surrounded by air. They hit upon the idea of enclosing the filament in a bulb from which the air had been removed as far as possible. There were many who did not believe that the air could be removed from a container sufficiently to enable these inventors to make their lamps successful, but they persevered in spite of ridicule, with the result that their filaments were given a comparatively long life and began a movement that has led to the almost universal use of electricity for lighting purposes.

These pioneer electric light bulbs were the first instance of the use of a vacuum for electrical purposes. Since then innumerable ways of apparently getting something out of nothing have been discovered. Scientists were not content with obtaining light from empty glass vessels, and we now use vacuum tubes of special design for the production of mysterious invisible rays, usually called X-Rays, that enable us to see deep into opaque objects. The modern wireless valve, whether it is of the comparatively small type included in receiving sets, or is a giant intended for use in a powerful transmitter, also depends on the vacuum for its action, and a mighty array of vacuum tubes have been introduced for various special purposes.

Every year the amount of empty space enclosed within glass walls and put to practical use increases. More than 300 million vacuum tubes have been produced for wireless purposes alone since these were first manufactured on a large scale and, to speak paradoxically, the empty space within these would more than fill the world's largest cathedral!



The exhaust apparatus in use for removing as much air as possible from vacuum tubes employed in electrical work. Photograph by courtesy of General Electric Company of New York.

As a matter of fact it is not really correct to describe the "vacuum" within a tube of this kind as an empty space, for it is impossible to remove every trace of the oxygen, nitrogen and other gases that constitute the atmosphere. In the nearest approach to the perfect vacuum tube yet produced there were no fewer than 370 million molecules, or tiny particles, of oxygen and other gases, although the vessel concerned was a glass globe only 5 in. in diameter. This number seems enormous, and suggests that a vacuum tube is very crowded. This is far from being the case, however, as may be realised by comparison with a tube containing air at ordinary atmospheric pressure. Such a tube looks peaceful, but in reality its interior is crowded with millions of tiny particles restlessly rushing backward and forward. The traffic is incredibly dense, and no order is kept, with the result that collisions are very numerous. The average distance over which each of these molecules travels before bumping into another is considerably less than a thousandth of an inch; whereas a vacuum tube of the kind employed for electrical purposes the average free run of a molecule is more than 100 yds. Of course, a molecule in a wireless valve or other vacuum tube never succeeds in travelling such a distance, for it is stopped by the glass walls of the vessel containing it.

This leads us to the secret of the efficiency of the vacuum. By pumping out as much air as possible, room is made for the mysterious particles called electrons, the tiny atoms of negative electricity, to get to work. In certain tubes, they are set free from a tungsten wire, or from a filament covered with earths, when these are heated by passing an electric current through them. The electrons are shot off at high speed and travel in straight lines from their place of origin. In air at ordinary pressure they would run a great risk of collision with the jostling mass of molecules already referred to, and of never reaching their destination.

In a vacuum tube the electrons pass comparatively unhindered across a far less crowded space in order to carry out the task assigned to them. For instance, in a wireless valve they are attracted towards the plate, or anode, in order to complete certain electric circuits. The rate at which they pass across the intervening space is governed by the electrical potential of the grid, which acts like a traffic policeman. In the photo-electric cell, the working of which was explained last month, the electrons are stirred into action by means of a ray of light, which displaces them from a metal such as potassium. They stream across the practically empty space of the bulb in which the potassium is placed to a second electrode, and so complete electrical circuits outside the vacuum tube. When they are stopped, as when the beam of light falling on the cell is interrupted, the outside current ceases to flow, and relays then automatically come into action by means of which electric devices can be made to open doors, check and count traffic and perform many other wonderful feats.

It is curious to reflect that when working on his pioneer electric lamps, Edison took the first step in this great development of the vacuum tube. He noticed that the interior surfaces of the bulbs of his lamps invariably became blackened, except for a sharply defined space that looked as if it had been made by drawing a finger down the smoky glass. This led him to make further experiments with a bulb containing a metal plate connected to the positive terminal of the battery supplying the lighting current. To his surprise, he found that an electric current then somehow leaped across the gap between the filament and the metal plate. Not until 30 years later did scientists realise that the mysterious current discovered by Edison was really a stream of electrons shot off at high speed from the glowing filament, but many electrical miracles have resulted from the efforts to get something out of nothing that followed.



TRICKS WITH MAGNETISM AND ELECTRICITY

THIS month we propose to describe experiments with the contents of the Elektron Outfits that may almost be described as conjuring tricks, for in them magnetic and electric forces are made to bring about curious and amusing results, while the means employed to develop these powers are concealed as far as possible. It is not always possible to hide the apparatus employed, but this is not necessarily a disadvantage, for the effects of magnetism and electricity are sufficiently mysterious to most people to arouse their wonder and interest.

To begin with, an interesting series of experiments can be carried out with no other apparatus than the Ebonite and Glass Rods included in the Outfit and a few of the small celluloid swans, fish and other creatures that are to be obtained for a few pence from almost any toy shop. Our first illustration shows a miniature swan, floating on water in a large basin, being pulled forward by the invisible force exerted by an electrified Ebonite Rod. This Rod has been rubbed lightly with the Flannel Square held in the left hand of the experimenter, and when it is passed across the basin near the head of the swan, the bird obediently swims towards it and follows it about. It is very interesting to watch the swan change its direction, swinging quickly to left or right as the Rod is moved sideways. If care is taken to warm the Rod and the Flannel Square in order to have them in the best possible condition, the attraction will be so powerful that the unwary experimenter will find it difficult to prevent the swan's beak and the Ebonite Rod from coming into contact.

An interesting variation of this trick is to cut a strip of rough brown paper about 1 ft. in length and 2 in. in width, and to electrify one end of this by vigorous brushing with a stiff clothes brush. The swan will then follow the electrified brown paper with the same docility as it displays in its pursuit of the electrified Ebonite Rod.

Two or three friends can derive great excitement from a race based on this experiment. Each is given a celluloid swan, which he places alongside those of his rivals on a starting line at one end of as large a bowl as is available. Each of the competitors then brushes a strip of brown paper, as already explained, and at a given signal they begin to lure their swans across to the opposite side of the bowl by means of the electrified strips, the one who persuades his bird to arrive there first being declared the winner. The swans should not be allowed to touch the papers, and any competitor who breaks this rule accidentally must be penalised by having his swan replaced on the starting line.

An ordinary bowl does not offer much scope for a race if swans of the size illustrated in Fig. 3 are employed, nor does it give sufficient room for the movements of the competitors, who are apt to become a little excited! A zinc footbath may be more suitable, but the best of all is the household bath, provided that permission can be obtained for its use, for this will give a course of excellent length.

Several variations may be made in the conditions of a race of this kind. If there are only two competitors, each may be armed with an electrified Ebonite Rod; while the addition of a third may enable the relative merits of Ebonite and Glass Rods to be tested. Celluloid fish and other creatures may be substituted for the swans, but every entrant should have one of the same kind in order to avoid differences in weight and resistance to movement through the water.

Contests in which table tennis balls figure may be arranged in a similar manner. The best course for such a race is the top of a table from which the cloth has been removed. The surface should be level, for otherwise the balls would roll about out of control, and strips of electrified paper, or Glass or Ebonite Rods that have been rubbed with Silk or Flannel Squares, are employed to work up speed. As before, penalties follow if a ball touches the electrified material.

Other interesting electrical experiments that may be included are described in the No. 1 Elektron Manual, one of the most attractive being dealt with on page 15 under the heading "An Amusing Electrical Game." In a similar experiment that has the advantage of being quickly arranged, small pieces of paper cut in the shapes of dolls may be made to dance about in a comically spasmodic fashion. Very thin paper is required for this purpose, and the figures should only be about half an inch in length in order to prevent them from being too heavy. They are placed on a table covered by a good thick cloth and a sheet of glass is fixed over them, with its ends resting on two books to raise it to a suitable height. The glass is then rubbed with silk, and the puppets immediately jump towards it and fall back again.

As in all experiments in which frictional electricity is employed, care must be taken to have all materials used in this game dry and slightly warm in order to achieve good results.



Fig. 1. A doll loaded with iron nails and immersed in water is caused to "dance" by means of an electro-magnet concealed in the stand.

Another experiment that could well be included in our display of tricks is the one described in last month's "*M.M.*", in which a nail is drawn so realistically on a sheet of paper, or thin card, that a key can be hung on it. Magnets generally lend themselves well to experiments of this kind, for their invisible force passes readily through paper, wood, glass and other substances that are non-magnetic in character, and its source may therefore be concealed.

More striking results follow when electro-magnets are substituted for permanent magnets, for then the experimenter has complete control, and is able to bring the magnetic forces into play and to destroy them by means of a switch.

An example of the use of an electro-magnet for this purpose is illustrated in Fig. 1. The doll shown floating in the jar of water is specially treated to make it float upright and to enable it to respond to the attraction of a magnet. One of its arms was removed and through the opening this made sufficient small nails were inserted to make it sink until its head was just immersed. These nails fell into the feet of the doll and kept it upright in the water. The arm was then replaced, and holes through which

water could pass were closed by means of sealing wax.

Two or three dolls can be employed, but they should be quite small, in order to keep their buoyancy within reasonable limits. Dolls two in. in length are suitable. Care also should be taken in choosing a jar. The magnetic force on the dolls is decreased as their distances from the poles of the magnets are increased, and a small jar with a thin bottom is the best kind to use.

The electro-magnet employed in this trick consists of a single Magnet Coil, in which a Magnet Core is inserted. It is placed vertically on the Universal Base, the threaded end of the Magnet Core being passed through one of the holes in this, a Nut under the Base securing the electro-magnet in position. The ends of the winding of the Magnet Coil are connected to the terminals of the Bichromate Cell, and the Switch is included in the circuit.

When ready the electro-magnet is placed inside a cardboard box of just sufficient depth to cover it, and a hole is cut in the top of the box immediately above the pole of the magnet. The jar is placed over the hole, and on completing the circuit the metal contents of the feet of the doll are attracted towards the electro-magnet. The result is very amusing, for the doll sinks slowly until its feet touch the base of the jar. By alternately pressing the key of the Switch and releasing it quickly the doll may be made to dance up and down in a very amusing manner, especially if the Switch movements are carefully timed.

Much of the effect of this trick depends on its presentation, for clearly it is more exciting to onlookers when the cause of the movements of the doll are not displayed and must be guessed. The manner in which the devices required are concealed depends entirely on the position and resources of the experimenter. The trick is very effective when the wires for the electro-magnet pass upward through tiny holes in the table into the box, and when the box itself is made inconspicuous by building up on the table a platform of equal height over which a cloth has been placed.

The Bichromate Cell employed may be hidden in any suitable position, provided a sufficient length of wire is available, but it should not be taken too far away owing to the increase in resistance that this would introduce. The connecting wires are best hidden by fastening them to the table leg. The Switch can be concealed under the platform until it is wanted and can then be removed to the experimenter's pocket. This enables him to stand away from the table with his hands in his pockets. In this position he is able to control the movements of the doll although there is no apparent connection.

A plan that is even better is to place a confederate behind a door or curtain that hides also the Bichromate Cell and Switch. The movements of the doll can then be regulated in accordance with a scheme previously arranged, and the experimenter can move about freely while carrying out the trick.

In another attractive experiment one of those who are taking part in the demonstration is electrified. Merely rubbing the hand with the Silk Square, or with a silk handkerchief, produces electrification, but as the human body is a conductor, it is impossible to detect the electricity produced unless special precautions are taken to avoid its leakage to earth. Some form of insulation therefore must be provided. A good plan is to dry four strong thick tumblers by keeping them in a warm place for some time after removing as much moisture as possible with a cloth, and to place these upside down on the ground as supports for a small wooden platform. Another plan that is equally effective is to place each of the four legs of a chair inside a large glass jar that also has been thoroughly dried. Empty 4 lb. jam jars are very effective, especially if they are placed on a good thick carpet.

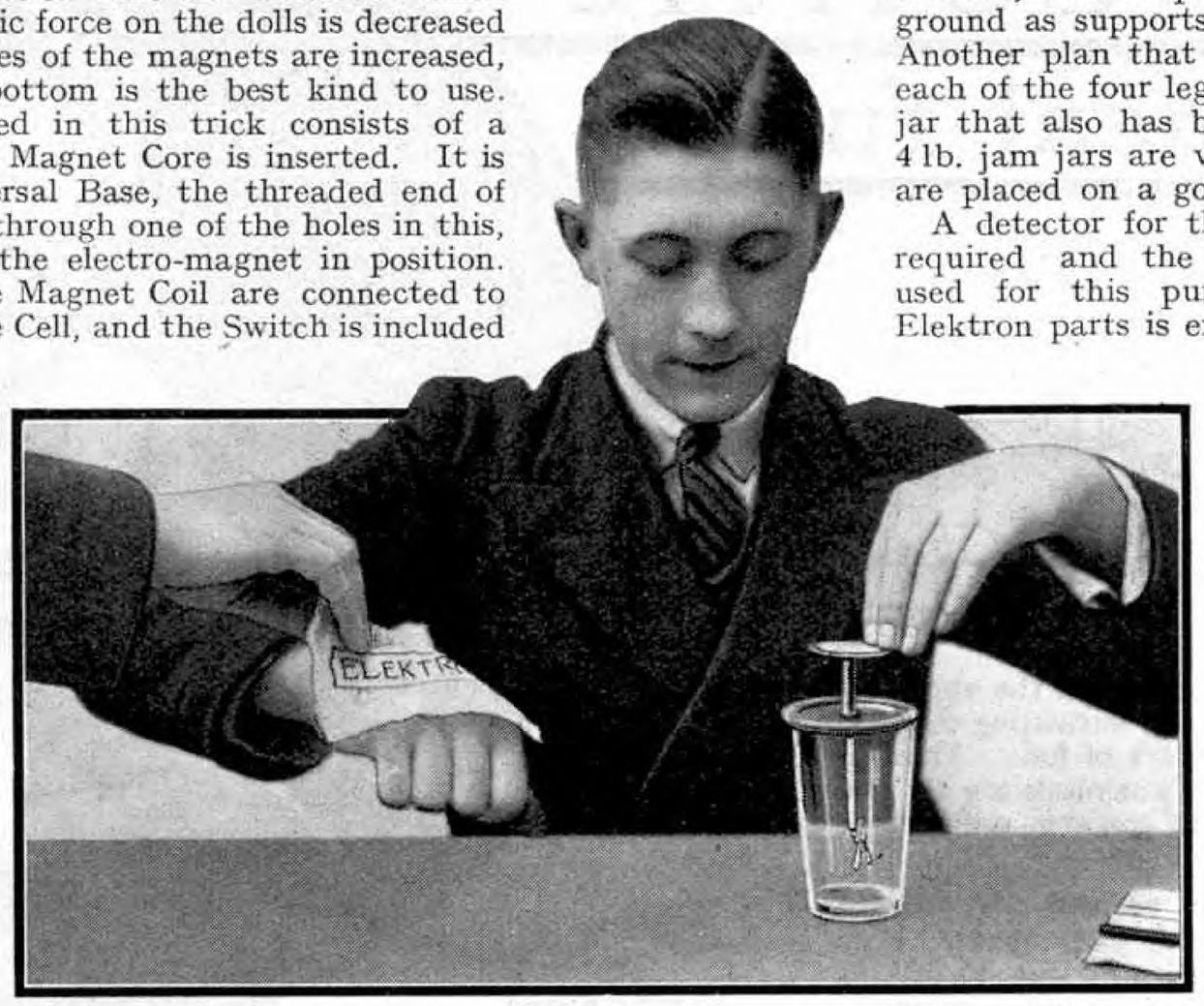


Fig. 2. The experimenter himself becomes electrified, when he is flicked with the Silk Square, as shown by the movement of the leaves of the electroscope.

A detector for the electricity generated also is required and the Elektron electroscope can be used for this purpose. Its construction from Elektron parts is explained in the Elektron No. 1 Manual, and it is very sensitive to the presence of electricity, its aluminium leaves immediately repelling each other.

The victim of this trick stands or sits on the insulated support provided for him, taking care that no part of his body is in contact with the ground or with any other object. He places the tips of the fingers of one hand on the brass Plate of the electroscope, and holds the other out, as shown in Fig. 2, to allow it to be flicked with the Silk Square, or with a silk handkerchief.

Although the amount of electricity produced in this manner is very small, the aluminium strips in the electroscope repel each other owing to its presence on them. This interesting experiment also illustrates the fact that the human body is a good conductor, for the electricity readily passes to the leaves of the electroscope, although there is a considerable distance between the two hands of the individual who is electrified. The victim does not feel the small charge he is given, and in fact would be unaware of its presence if it were not for the electroscope acting as a detector.

The Elektron Shocking Coil should not be overlooked in an entertainment devoted to magnetic and electrical wonders. There is no end to the fun that may be obtained from it, and everybody present at a show of this kind will be delighted to take part in a series of "shocking" experiments of the kind described last month. Other experiments described in these pages and in the Elektron Manuals also may be introduced with advantage and, with those dealt with in this article, provide ample material for a good display.



Fig. 3. Drawing a celluloid swan around a basin of water by the attraction of an electrified Ebonite Rod. An electrified Glass Rod produces the same effect.

Keen and enthusiastic owners of Elektron Outfits will find that the contents of these lend themselves to interesting variations of the effects described. For instance, the trick with the obedient doll can be extended by introducing a second doll containing nails that have been magnetised by stroking them with one pole of the Bar Magnet. Care should be taken to stroke all the nails in the same direction and with the same pole of the Bar Magnet. Thus they may be magnetised by drawing the north pole of the Bar Magnet from the point to the head. When treated in this manner their points will be north poles and their heads south poles. The polarity of the electro-magnet employed can be found by noting its effect on the poles of the compass needle. Suppose that its upper end is a north pole. The doll charged with the magnetised nails then will sink more rapidly than the original one, if the nails are inserted head downward, for the electro-magnetic north pole will attract the south poles of the magnetised nails; and will be a reluctant diver if the points, or north poles, of the nails are directed towards the pole of the electro-magnet.

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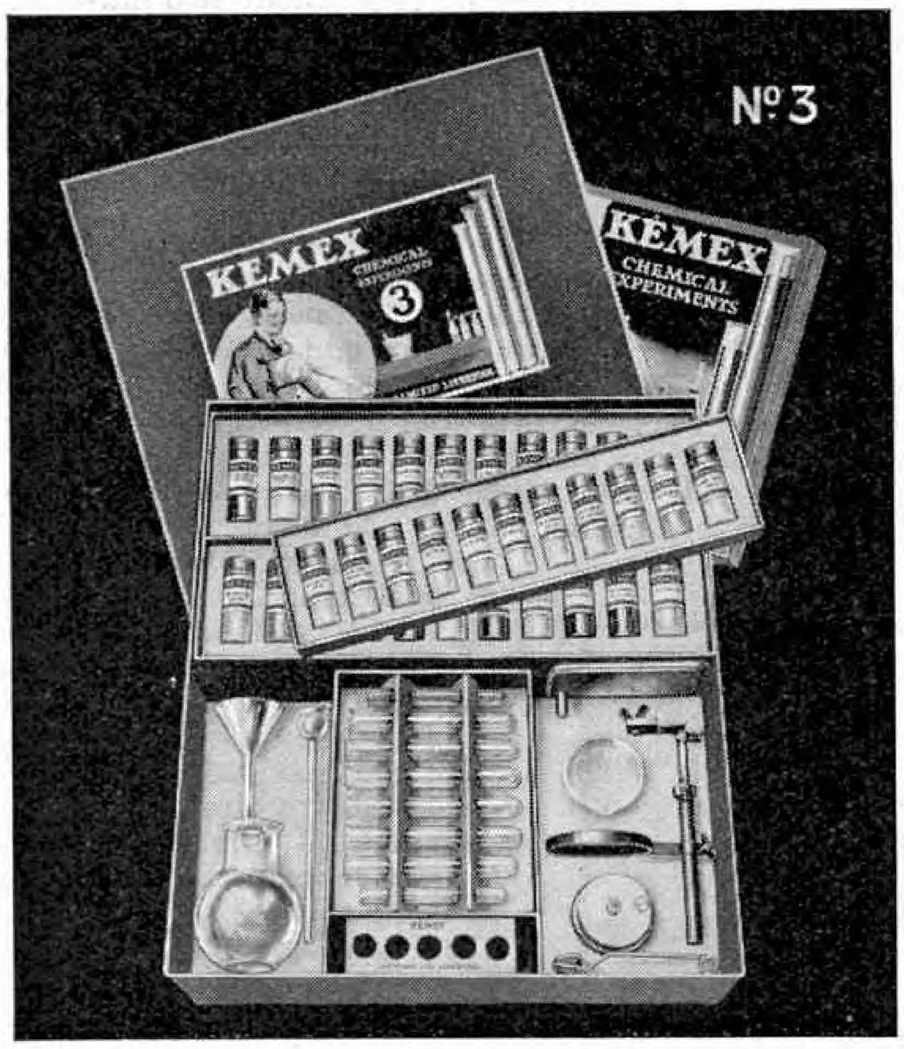




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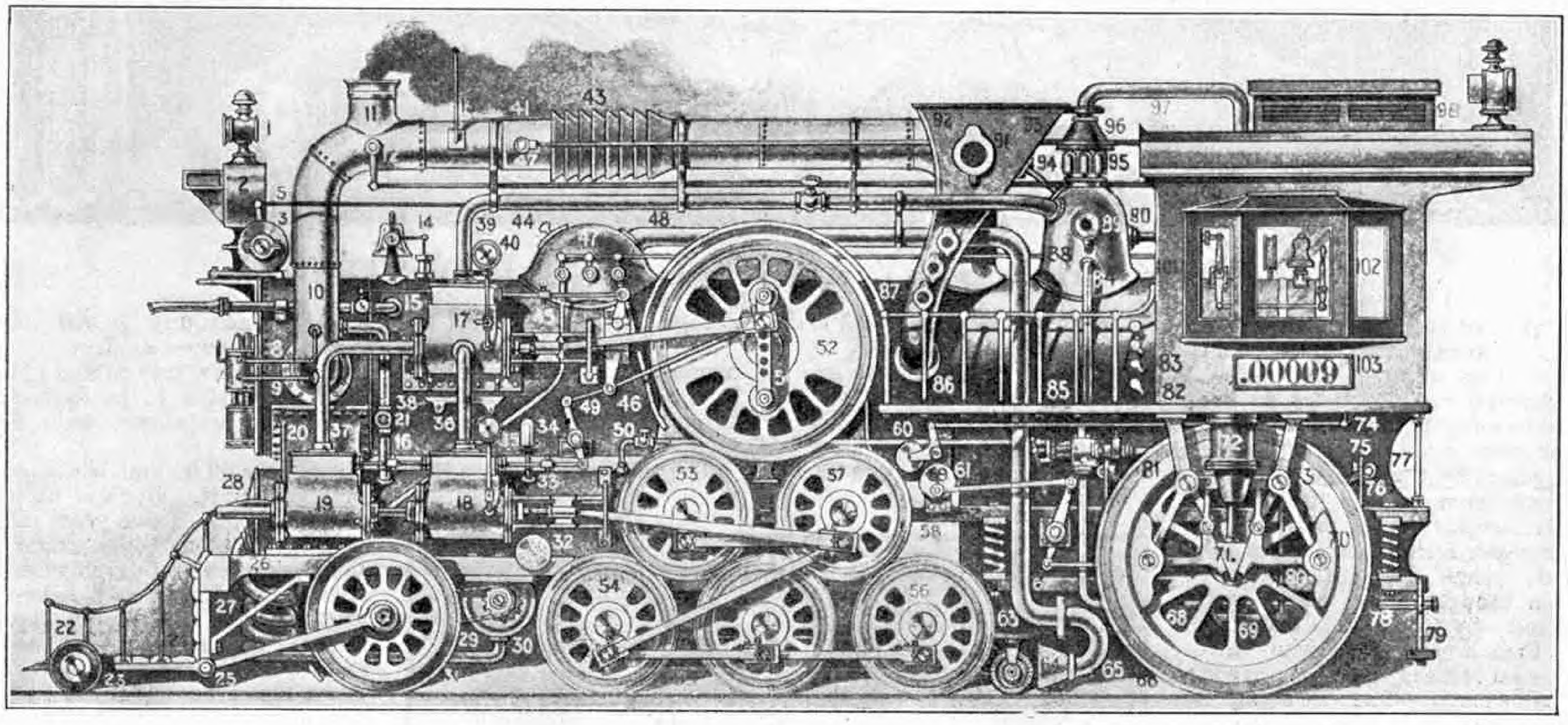
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The "Perfect" Locomotive



The "Perfect" Locomotive—according to its inventor!
Reproduced by courtesy of "The Railway Magazine."

WE feel sure that all readers will be interested in the remarkable locomotive illustrated on this page. We quote the following description of it from "*The Railway Magazine*," by courtesy of the Editor.

"A wonderful piece of mechanism in the form of a locomotive to which the word 'perfect' was applied by its inventor—one Eli Gilderfluke—many years ago. This weird contraption, which had a wheel arrangement impossible to describe, was overloaded with gadgets and complications, many of which had on the face of it been specially designed to defeat the purpose of others.

"Among other fitments ranking as part of the equipment of the locomotive were: (1) A high-power triple X-ray electric searchlight of 9,340 candle-power, 'to enable the driver to see round curves and through mountains.' (2) An 'anti-sleep-on-the-track' device, designed to make it very uncomfortable for any person or animal which strayed on the line, before the still more uncomfortable experience of being bumped by the engine could occur. (3) A new, and vastly improved, smoke pipe or 'carbo-wallop' for the swift conveyance of smoke, cinders and gases back to the fire-box for reincineration. (4) A bye-pass or 'deflectorbolus' so placed in the carbo-wallop as to enable the driver, should there be too much smoke, ashes or cinders returning to the fire-box, thereby causing too intense a fire, to direct such smoke or gas into the chimney and allow them to pass to the atmosphere. (5) A complicated arrangement of steam-operated main cylinders, forming a 'trunk-cross-steeple-tandem-compound' system of such marked economy as to effect a proved saving of 87.8 per cent. over the steam consumption of the best designs of the then standard locomotives, and (6) an arrangement incorporating tripod-traction wheels, with 'blind' or 'bald' tyres, mounted in such a manner as to produce a perfect balance of the reciprocating parts and thus produce the smoothest running engine ever built, so smooth and noiseless that at a speed of 119 miles per hour the engine would make no more noise than a tom cat in crossing a wooden bridge.

"These are only a few of the more spectacular features of the equipment, a complete inventory of which would occupy more than a page of this journal to enumerate. The specification concludes with the statement that 'the inventor stands ready to demonstrate the economies of this engine on any kind of paper, either with pen and ink or with a soft-lead pencil having a rubber tip'."

Readers will no doubt agree that this is a most extraordinary example of freak locomotive design! Of curious engines that have been proposed, but never actually built, a suggested type of compound locomotive may be mentioned that was designed in 1866 by David Joy, the inventor of Joy's valve gear. The high-pressure and low-pressure cylinders were to drive on to separate pairs of wheels; but these were not to be coupled up with side rods, as they were to be of different diameters! This engine, with its driving wheels revolving at different speeds, would have looked decidedly curious when in motion. Whether it would have been any more successful than the Webb three-cylinder compounds can hardly be decided, but it certainly anticipated the design of the latter in that the high-pressure and low-pressure cylinders were to be connected to separate sets of uncoupled driving wheels.



HOW CHEMISTRY AIDS A GREAT INDUSTRY

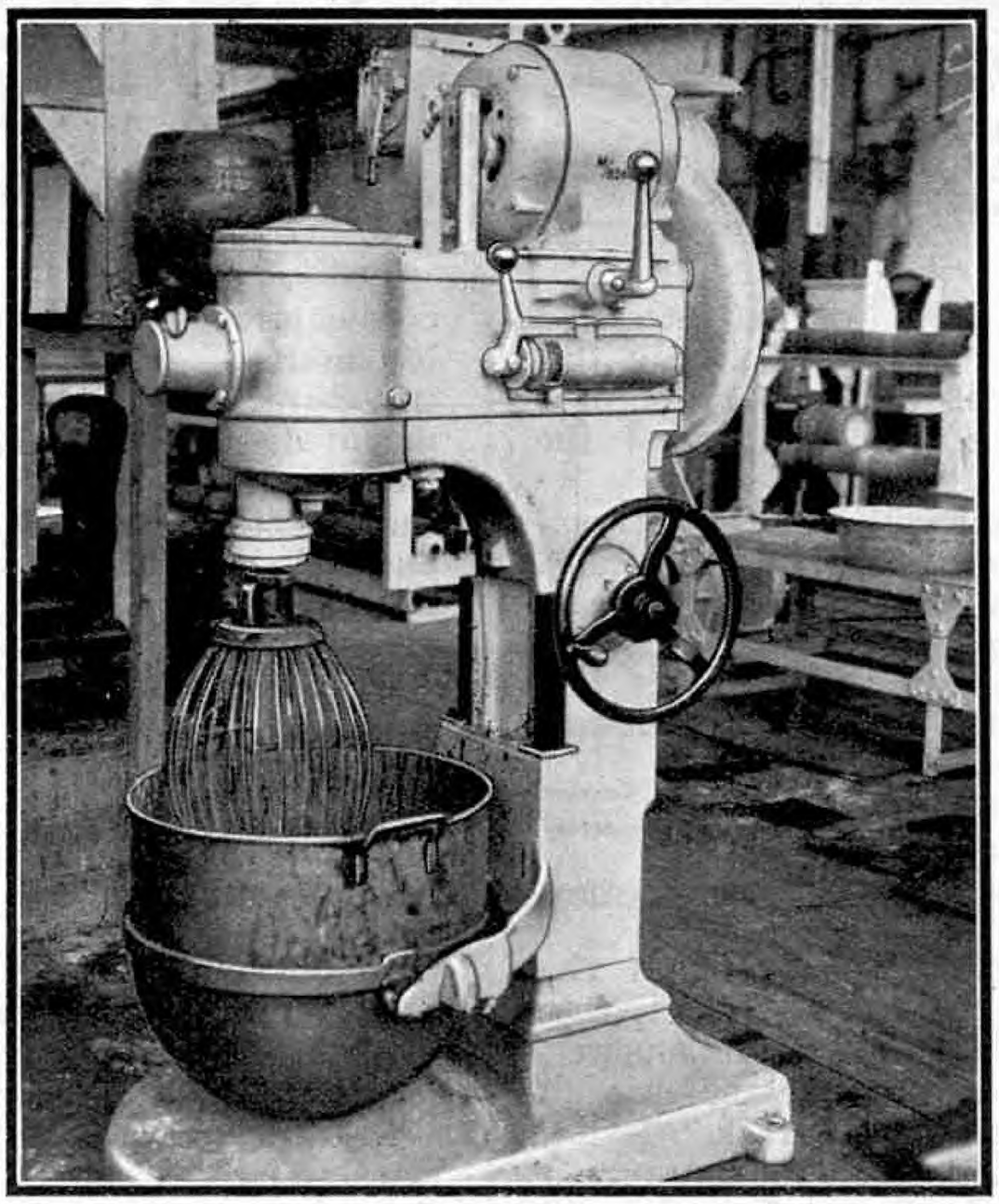
ONE of the most remarkable developments of modern times is the extent to which rubber is employed and the variety of uses to which it is put. Yet the history of rubber as an industrial product takes us back only very few years. It was unknown until the discovery of the New World, when Columbus and other Spanish and Portuguese explorers described a ball used in games by the natives of South America as being made from an elastic gum exuded from trees, and samples of the material did not reach Europe until more than 200 years later. They were then brought across the Atlantic Ocean by de la Condamine, a French traveller, who introduced their native name "cahucha." The meaning of this word is "tears of wood," and it gave rise to "caoutchouc," the name formerly used for this elastic material. Its value for erasing pencil marks was discovered in the later years of the 18th century, and to this property we owe its present name.

Later investigators began to probe more deeply into the nature and properties of rubber, and the efforts of Macintosh and Hancock in this country, and of Goodyear in America, led to the discovery that raw rubber heated with sulphur, or certain sulphur compounds, yielded a material that could be rolled, pressed and moulded, and was much more useful than the original rubber. When treated in this manner rubber is said to be vulcanised, and as new applications were rapidly discovered for it, the industry grew until it reached enormous proportions.

Chemists continued to investigate the material in order to discover improved ways of working it, and efforts were made also to increase the yield of rubber from the tree that produces it, and to obtain purer raw material. For this purpose it was necessary to go to the source of rubber. The result of research work on these lines has been almost startling, for it has effected a revolution in the rubber industry, and promises to make this substance even more useful than it is at present.

In order to understand recent developments due to the work of the chemist in this sphere, it is necessary to realise the form in which rubber is produced. It is obtained from the trunk of *Hevea Brasiliensis*, a tree that originally grew only in South America, but is now planted on an enormous scale in the Malay Peninsula and other countries in the East. The manner in which this development was brought about is one of the romances of industry. The export of seeds of the rubber tree from Brazil, its native place, was formerly forbidden, but about 60 years ago a British expedition under Sir Henry Wickham braved the dangers of the tropical forests of that country, and the hostility of their savage inhabitants, and succeeded in collecting 70,000 seeds. These were shipped to this country and sown at Kew. Only a small proportion germinated, and many of the tiny rubber plants obtained died when they were sent to Ceylon to be replanted. From the few survivors the great rubber plantations of the East have been developed.

The rubber tree grows to a height of over 60 ft. and has a girth of about 10 ft. Regular tapping begins when it is five years old, a sloping incision being made in the bark of such a depth that the rubber-containing cells below it are reached. A milky liquid, known as latex, then slowly exudes from the cells and runs down the groove formed by the cut into a vessel placed at its foot in order to collect the liquid in readiness for treatment at a central station.



The giant whisk that whips latex into froth in the manufacture of "Dunlopillo" goods. The photographs to this article are reproduced by courtesy of Dunlop Ltd.

The Indians of South America prepared rubber by dipping wooden paddles into the latex and holding them over a smoky fire, repeating this process until they obtained a large ball of rubber. In the plantations of the East, all the rubber formerly produced was separated from the latex by adding acetic acid or formic acid. In each case the solid rubber was then despatched to factories in various countries, where it was washed, vulcanised and manufactured into various articles.

The efforts of the chemist have led to the discovery of means of obtaining rubber that are far more efficient than these, and the product is superior in many respects to the raw material previously employed in the industry. Examination of the latex by means of powerful microscopes has revealed the presence in it of tiny particles of rubber suspended in a liquid that is mostly water. The latex in fact may be compared with ordinary milk, which owes its characteristic appearance to the suspension, in the thin liquid known as whey, of very minute globules of cream, or butter fat.

The particles of rubber in latex are incredibly small, and more than 10,000 of them could be arranged side by side in a straight line on a half-penny. They are pear-shaped, and are in continual movement, darting hither and thither in a series of sharp dashes over small distances. Each is a miniature rubber warehouse, for it consists of an outer skin lined with a shell of viscous rubber, the two surrounding the fluid rubber that forms the centre.

Latex resembles milk also in its tendency to curdle. In the case of the animal liquid, the clot formed when natural curdling takes place, or when this process is hastened by the addition of an acid, consists of cream cheese. The curdling of latex yields rubber and, as we have seen, the usual practice for many years has been to separate this in solid form by the addition of an acid. Better

methods of separating cream from milk have been discovered, and to-day the liquid is whirled round in centrifugal machines to part the globules of cream from the whey in which they are suspended. Similarly, centrifugal machines are now used to separate rubber from the latex extracted from the trees. On the Dunlop plantations in Malaya, the latex is brought in tank wagons to the factory, and there it is placed in metal containers that revolve at high speed. The liquid in which the rubber particles are suspended is whirled into the outermost layers, leaving the rubber itself, which is lighter, in the inner layers. The containers are designed to enable the two portions to be run off separately, and the flow is so adjusted that the volume of "cream," or concentrated latex, is about half that of the original liquid.

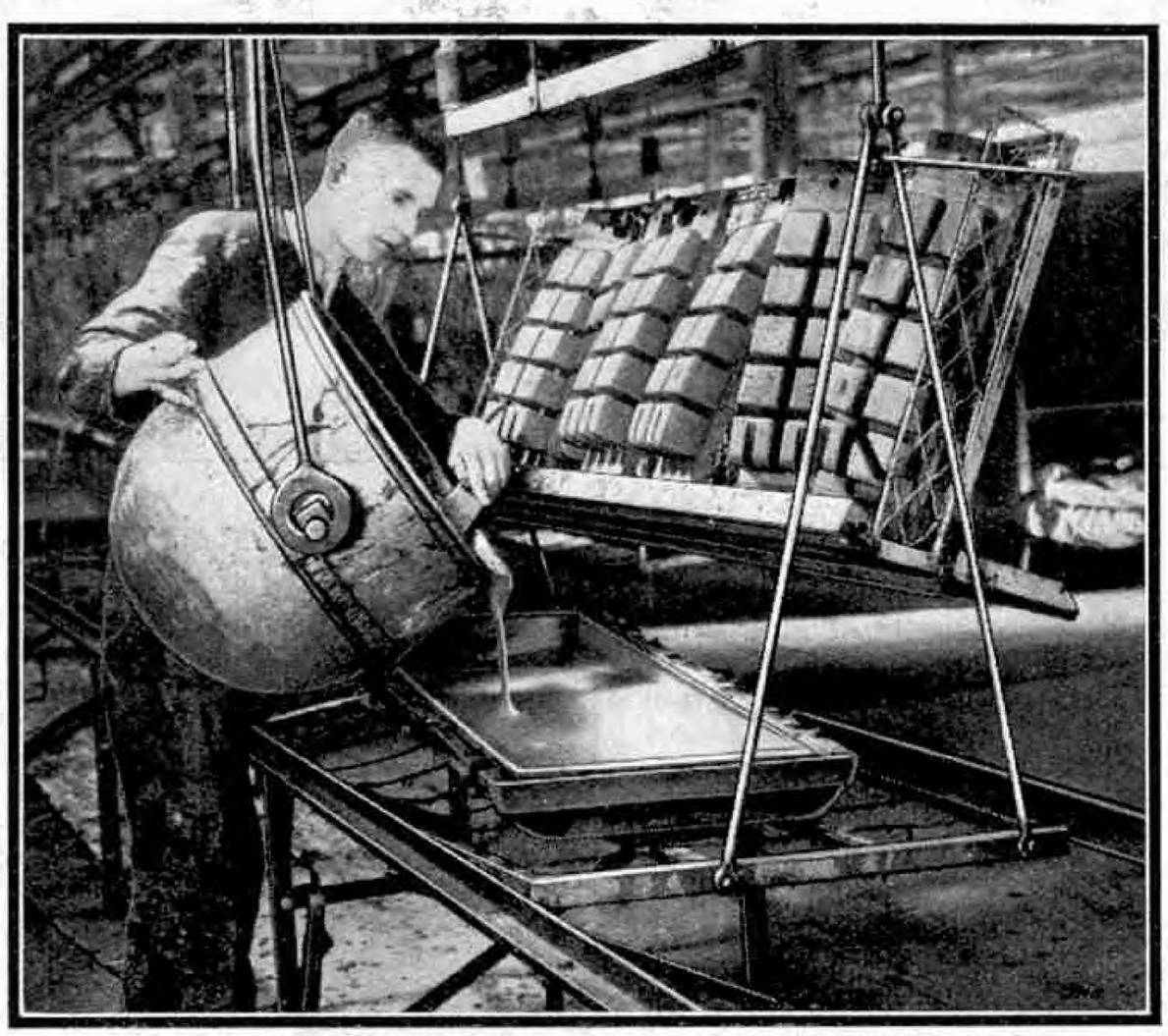
This treatment is not sufficient to enable rubber latex to be transported overseas to the rubber factories, for curdling would take place naturally, with the separation of the rubber in the ordinary form. This must be prevented, and therefore as soon as the latex reaches the concentrating plant a preservative is added to it. Since acids cause the coagulation of rubber, alkalies should be the best preventives of curdling. This is the case, and the alkali that is employed for the purpose is ammonia, which is used in sufficient amount to make its proportion half of one per cent. of the bulk of the cream.

The result of these operations is a mobile fluid known as Dunlop "60 per cent." Latex. It contains 60 per cent. of rubber, the excess of water, and suspended foreign matter and dirt, having been removed. Thus it is purer than the rubber separated by curdling with acid, and in fact is in a doubly-refined condition.

The concentrated latex is run into underground tanks of large capacity in order to form a uniform stock, and from these it is pumped into railway tank wagons for transport to Singapore, where it is delivered into storage tanks. There it awaits the arrival of a rubber tanker, and is then forced by means of compressed air into the containers of this vessel. It is very important to keep everything clean in order to ensure the preservation of the latex during its long journey overseas. All pipe lines, valves and connections therefore are so arranged that they can be readily taken apart for inspection and cleaning, and the ship's tanks also are thoroughly cleaned before the latex is put in.

The storage tank system is employed also at the port of entry into this country, in order to enable the latex to be readily discharged from the carrying vessel. This system of handling latex in bulk is being steadily developed, and very soon will be universal, but as yet a proportion of latex comes into this country in steel barrels holding 50 gallons, that are filled and sealed at the plantations.

On arrival at the Dunlop Factory the latex is pumped into large storage tanks, from which it is removed as required to mixing tanks. By that time the ammonia has finished its work, and it is removed by evaporation. It is interesting to realise that this preservative leaves behind it no residue, for it is completely volatile. This explains why it is used in preference to caustic acid and other non-volatile alkalis, for these could not be removed from the latex by evaporation, and would remain as impurities in the goods manufactured from it.

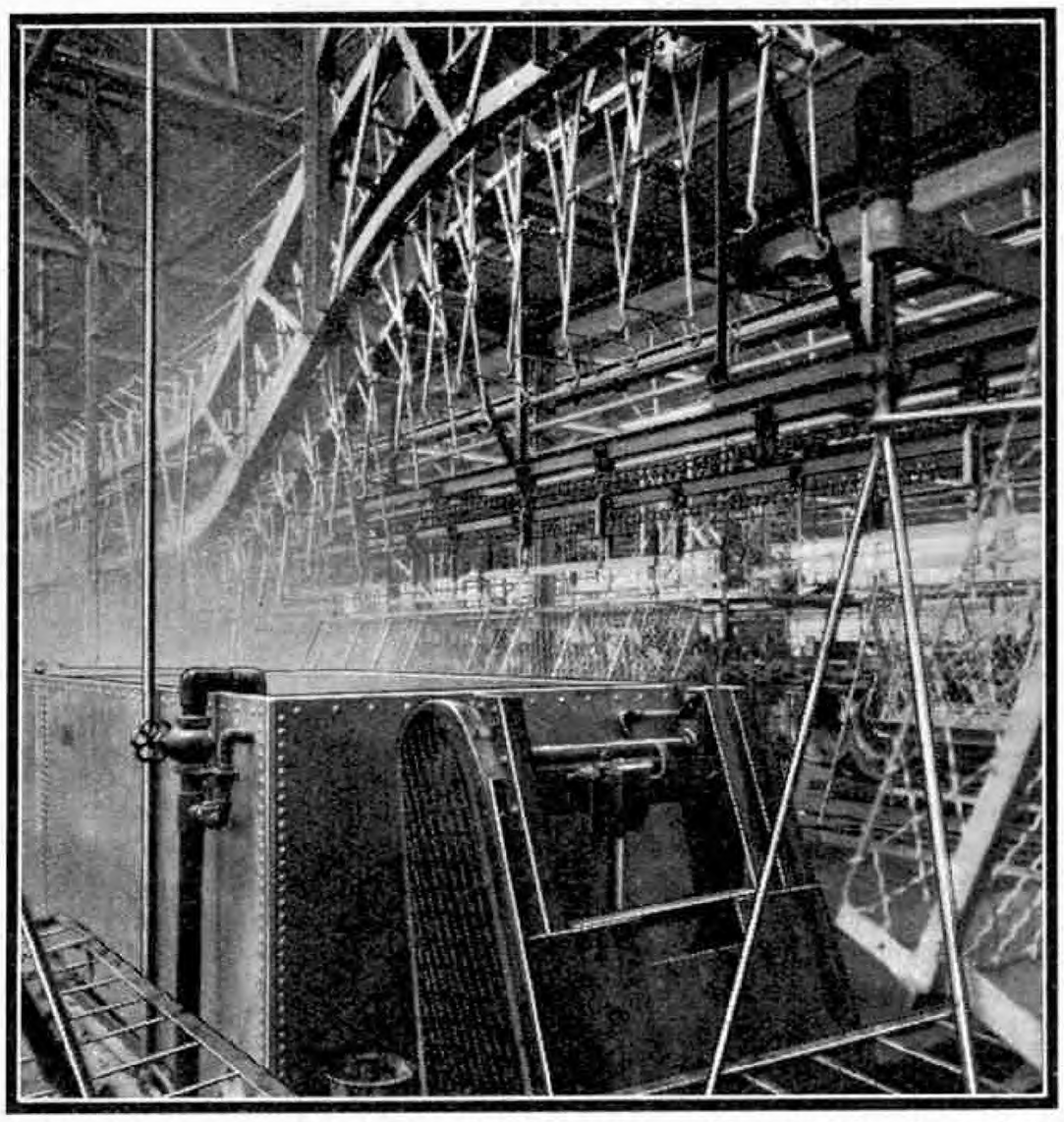


Pouring latex froth into moulds. It sets as soon as the lids are closed.

In the mixing tanks, vulcanising agents and the special ingredients required are added to the latex in order to make rubber suitable for one of the many purposes to which this material is put.

In order to realise how latex is used, suppose that we are following the manufacture of Dunlopillo Cellular Cushion Latex. This is porous, but the pores are extremely minute, and the rubber itself is superior to sponge rubber in its wearing qualities and its resilience. It also possesses the advantage that it may be moulded in units of any size or shape, and it is finding increased application in the making of motor car seats and upholstery of all kinds.

The manufacture of this wonderful material is an interesting process. From the mixing tanks, the latex is carefully weighed out into the container of a machine that incorporates what may be described as a giant egg whisk. This whisk is dipped into the liquid and rotated at high speed, whipping the latex into a frothy mass full of tiny air bubbles. While in this condition the liquid is poured into moulds, the lids of which are immediately closed. The froth sets almost immediately, and the moulds are then placed on conveyors that carry them without vibration to a large tank of boiling water. This tank is 60 ft. in length, and the moulds remain in the boiling liquid for about an hour. During that time the vulcanisation is completed, and the rubber reaches its permanent condition. It also takes up the shape of the moulds, and when these are opened the cushions and other articles are dried by whirling them round in a centrifugal machine of the type employed in laundries. They are placed in a drying cabinet for from eight to 10 hours and are then ready to have any rough edges carefully trimmed off.



Tank containing boiling water, through which the moulds containing the set latex are passed in order to bring about vulcanisation.

Articles made in this manner are superior to those made from the dried rubber formerly exclusively employed as raw material, for this had to be kneaded between powerful rollers and mixed with various solvents in order to render it sufficiently plastic to be moulded or shaped. It lost much of the elasticity and natural liveliness of pure rubber when undergoing this treatment, but rubber goods manufactured direct from latex retain these qualities to the full. They are therefore stronger, more elastic, and more durable.

One of the most remarkable features of latex is the variety of processes that can be carried out with it. For instance, articles can be given a covering of rubber by spraying. This was extremely difficult with rubber solutions, and therefore was practically impossible before the introduction of latex.

Articles of metal and other materials can also be given thin coatings of rubber by electrical means. The tiny rubber particles are very sensitive to the passing of an electric current, which causes them to be attracted to the anode, or positive pole, on which they are deposited. This process can be described *(Continued on page 996)*



A CHEMICAL CONJURING ENTERTAINMENT

A CHEMICAL conjuring display is one of the most interesting forms of entertainment possible for Christmas parties and similar special occasions. The mysteries of chemistry are known to few people, and both young folk and grown-ups follow the details of a display of this kind with the greatest interest.

The owner of a Kemex Outfit will have no difficulty in arranging an attractive chemical conjuring performance, and no elaborate preparations are needed in order to make it successful. The tricks to be described in this article are straightforward from a chemical point of view, but can be made to appear very mystifying, especially if their effect is enhanced by a little stage management.

The experiments should be carried out on a table arranged for the double purpose of impressing the members of the audience and of giving the chemical conjurer the opportunity to carry out a few operations under cover. The apparatus required for each trick must be laid out in readiness, for there must be no waits or hitches during the performance; and the conjurer should carefully rehearse each trick, preferably with portions of the actual solutions he is to use, in order to avoid risk of failure through lack of practice. Having prepared all that he needs, he should then consider his general effects. A good plan is to fill large glass jars, such as 4-lb. or 2-lb. jam jars, with coloured liquids, and to place them in the forefront of the table in order to provide the screen behind which the few secret preparations necessary can be carried out. Suitable liquids include red and blue Litmus solutions, prepared by adding a little ammonia and Sodium Bisulphate respectively to equal portions of the solution made by boiling a few measures of Litmus with a test tube full of water. When cool this solution is divided between the two jars, which are then nearly filled with water and treated to give the required colours. A pink solution is prepared by dissolving a tablespoonful of washing soda crystals in a similar jar containing water and adding a few drops of Phenolphthalein Solution; while a splendid red solution is made from Congo Red, by dissolving sufficient of this in a jar full of water to give the required depth of colour.

If possible, the jars containing these coloured liquids should be arranged in front of an electric light in order to show up the colours of their contents to the best advantage. Another good idea is to display in a similar manner jars containing chemical gardens, prepared as explained last month. These will help to create a good impression, and at the same time will form excellent cover for the entertainer's secret operations.

A display of chemical conjuring is improved also by the use of a few coloured flares, especially when these are accompanied by a little smoke, for fire and fumes are the natural accompaniments of chemical wizardry! A harmless mixture for this purpose may be made of two parts Potassium Nitrate, one part Sulphur, and two parts Powdered Charcoal. These ingredients should be crushed separately in a glass or earthenware vessel, if this course is necessary with any of them, and then carefully mixed together by means of a short strip of wood or stiff cardboard. Care must be taken to avoid the use of metal vessels during the preparation, and only small quantities of the mixture should be made.

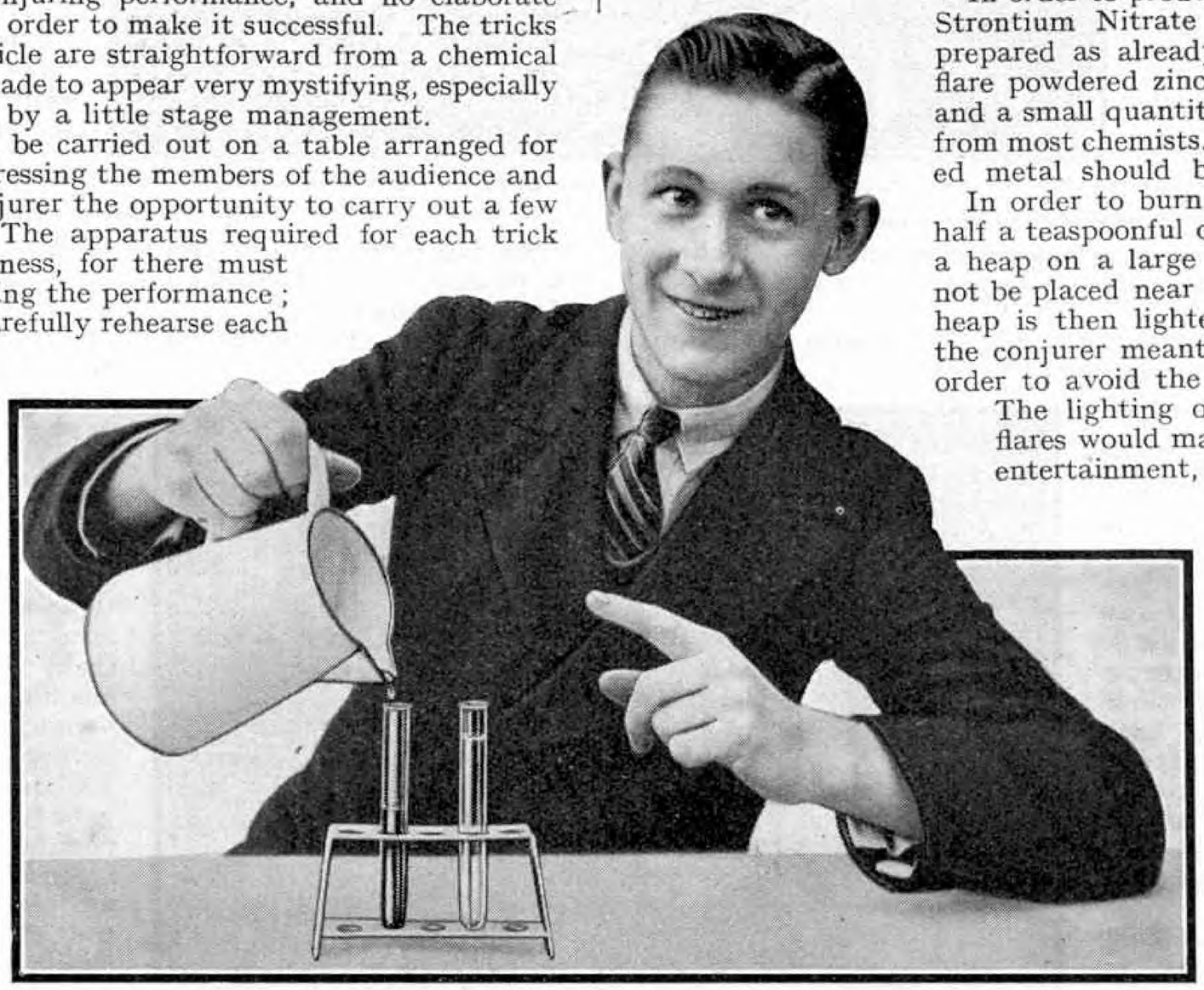


Fig. 1. Pouring wine and water out of the same vessel. How to perform this and many other interesting chemical tricks is fully explained in the accompanying article.

In order to produce a red flare, two parts of Strontium Nitrate are added to a mixture prepared as already described. For a green flare powdered zinc or zinc dust is necessary, and a small quantity of this can be purchased from most chemists. One part of this powdered metal should be added to the mixture.

In order to burn one of these flares, about half a teaspoonful of the powder is made into a heap on a large metal tray, which should not be placed near flames of any kind. The heap is then lighted by means of a match, the conjurer meantime standing well back in order to avoid the slightest risk of accident.

The lighting of two differently-coloured flares would make a good beginning to an entertainment, and other heaps could be lighted to fill up intervals between tricks.

The first trick consists of changing water into wine, and the wine back into water. This is simple, but very convincing, for the colour of the liquid changes almost instantly. Needless to say, the original liquid is not pure water, nor is the resulting one a genuine wine, and members of the audience should not be allowed to check the conjurer's statements by tasting!

The trick can be carried out well in a test tube, but is more impressive when performed on a larger scale in a tumbler. The vessel is half filled with water to which a few drops of Phenolphthalein Solution have been added. This is prepared beforehand, and it is a good plan to rehearse the trick with a portion of it in order to ensure that there shall be no hitch when the time comes for the actual performance.

The conjurer first draws attention to the appearance of the liquid in the tumbler, and then announces that he will change it into wine by merely stirring it with a glass rod. He repeats some gibberish on the pretence that it is a magical formula, or waves his glass rod over the tumbler, and stirs the liquid, which then becomes wine—or, to be more correct, is changed into a pink liquid that looks like wine!

The secret of this trick is to be found on the glass rod, for this is first dipped into lime water, which is readily made by adding a little Calcium Oxide to half a test tube full of water, and shaking. A test tube or evaporating dish containing this liquid is placed where it can be reached without difficulty, and concealed in the manner already suggested, in order that members of the audience do not notice the act of dipping the glass rod into it. The amount

of lime water taken up is insufficient to arouse suspicion, but readily brings about the remarkable change described, for lime is an alkali and therefore turns Phenolphthalein solution pink.

A considerable amount of fun is obtained by allowing a member of the audience to try his skill in this trick, care being taken to give him a clean glass rod, and to keep the lime water out of his reach. As a magician he will then be a hopeless failure!

Then follows the even more remarkable trick of turning wine back into water. In order to achieve this, the conjurer blows gently through it, using a glass tube for the purpose. The carbon dioxide in his breath then quickly neutralises the small amount of lime present, and thus causes the liquid to become colourless.

Again, the experimenter may claim that he is the only one who knows the secret, and in preparing a second glass of wine for any member of his audience who wishes to try to effect the change, he introduces either an overdose of lime water, or drops in a pinch of Calcium Oxide. The amount of alkali introduced will then be too great to allow the change to be effected quickly.

The climax of this series of tricks comes when the would-be magician has made vain efforts to turn the wine into water by blowing gently through it. The entertainer then tells him that his failure is due to lack of magical quality in his breath. Picking up a second glass tube, the conjurer dips this into the obstinate wine, blowing a few bubbles through the liquid immediately the tube comes into contact with it, and the wine is immediately transformed into a colourless liquid that looks like water!

Needless to say, the magic is not in the conjurer's breath, but in a bottle of hydrochloric acid, concealed with the lime water or in some other inconspicuous place, for the tube he takes up is one that has been dipped in this liquid. By placing his thumb over the top of the tube he is able to retain sufficient hydrochloric acid to neutralise the lime very quickly and to cause the liquid to become colourless. The efforts of his rival to effect the same change by blowing through the liquid attract the attention of the audience sufficiently to give him the opportunity of preparing the glass tube that he uses himself.

A very pretty variation of this trick is carried out by placing two test tubes or tumblers in full view of the audience, together with an earthenware or enamel jug full of water. The conjurer then announces that he will pour both water and wine out of his jug. He pours the liquid first into one vessel and then into the other, with the astonishing result that, while the liquid in the first of these retains the appearance of water, that in the second immediately becomes pink, its colour making a striking contrast with that of the contents of the first tumbler.

In order to effect this trick the "water" must be prepared beforehand by dissolving in it a teaspoonful of washing soda, and a few drops of Phenolphthalein Solution are poured into one of the test tubes or tumblers employed. Only sufficient of this liquid to wet the sides is necessary, and this remains practically invisible to the audience. The vessel that has not been treated is filled first in order to leave the surprising change for an effective climax.

There are many simple chemical experiments that can be made equally mysterious and attractive. One of these is the trick usually described as "writing with fire." All that is necessary for its performance is a small quantity of Potassium Nitrate. As much of this chemical as would cover a shilling is dissolved in a few drops of water, and the solution used as if it were ink in order to write or draw upon sheets of unglazed paper. Special care must be taken to make the writing or the lines of the drawing continuous, and the place where a start is made is marked with a cross.

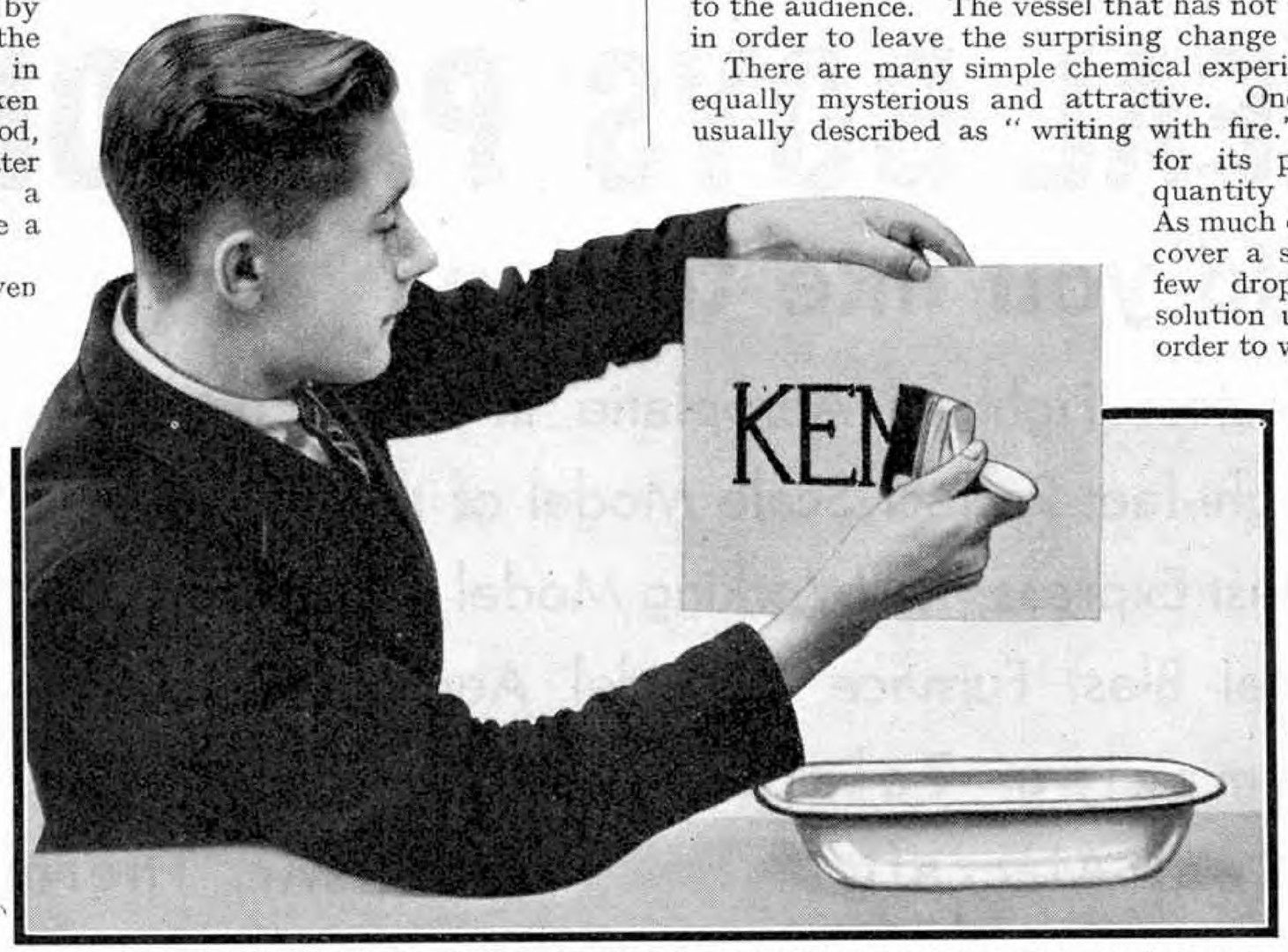


Fig. 2. The Magic Brush at work. It prints in black or blue ink when merely drawn across a sheet of paper.

When the paper is dry, the mark is touched either with a match, or with the red-hot end of a poker or a piece of wire. It immediately takes fire and burns without a flame, in exactly the same manner as a piece of fuse paper burns. The combustion spreads along the lines drawn by means of the colourless "ink," with the result that the diagram or words that have been written are traced by a fiery spark. Sheets prepared in this manner for use during the entertainment can be slipped when required into a simple framework, built up of Meccano parts, that holds them vertically in full view of the audience.

After writing with fire, it is an interesting change to write with water. This is as easy as writing with ink—if you take care to prepare the paper beforehand! A mixture of Tannic Acid and Iron Alum is spread in a very fine layer over a sheet of dry paper, preferably not glazed, and rubbed into its pores by means of a pad of cotton wool. The surplus powder is tilted off, and a pen nib that has been dipped in water then marks the paper as readily as if charged with ink. Actually the wet nib makes its own ink, for the water causes the chemicals on the paper to react, with the formation of a black precipitate, consisting of iron tannate.

The same two chemicals can be used in making what is usually described as a "sympathetic ink," or one in which secret messages may be written. In this case they are not mixed together. Instead they are dissolved separately in water, in each case one measure of the chemical being added to half a test tube full of the liquid. The message is then written with a pen or quill dipped in one of them. When dry this writing will be practically invisible, but will flash up in black letters when a sheet of blotting paper soaked in the second solution is pressed on it.

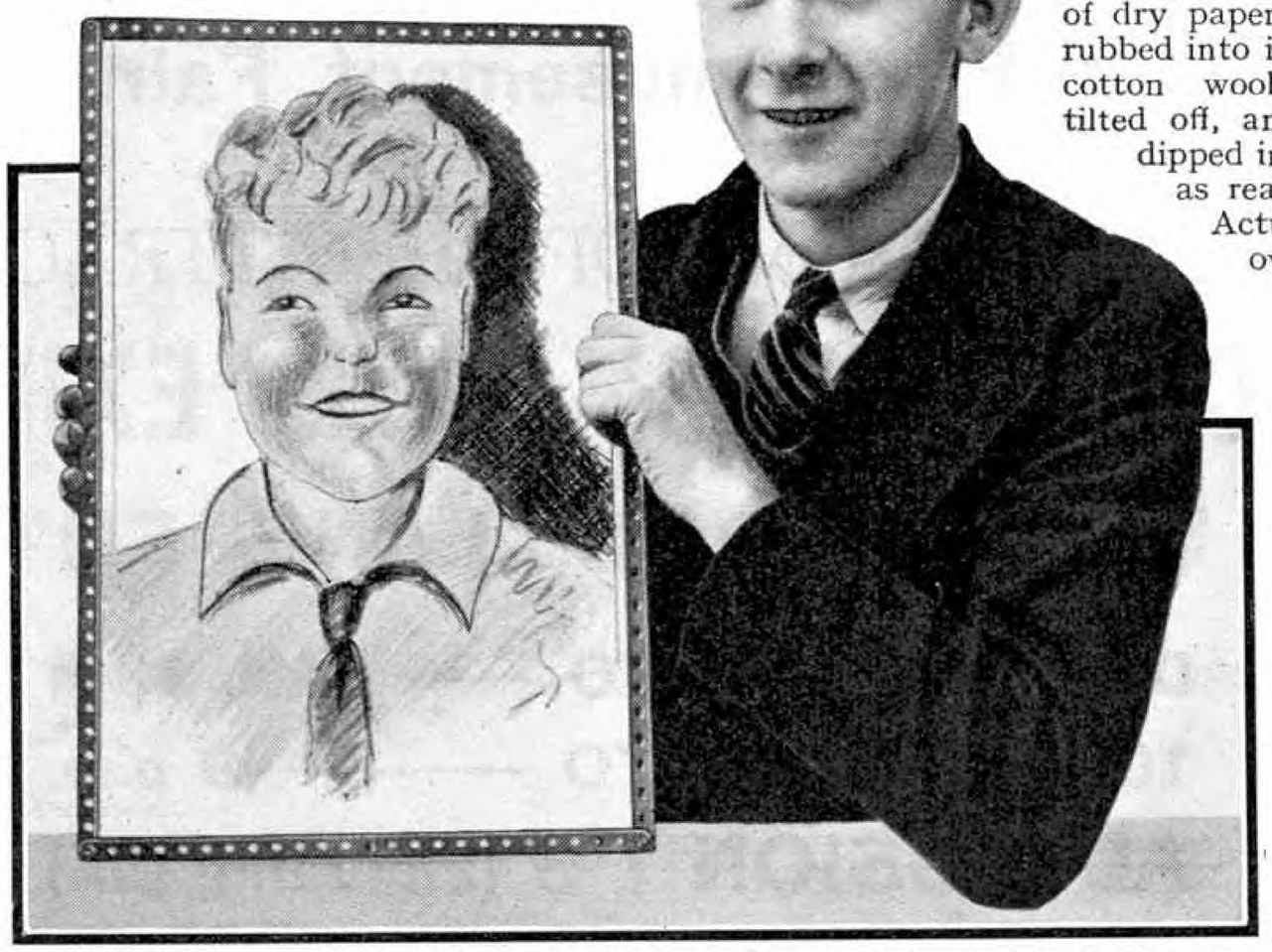


Fig. 3. The Blushing Boy, who is always a popular figure in a chemical conjuring entertainment. His cheeks glow crimson at the will of the experimenter, but quickly regain their normal colour.

A striking alternative method of showing this interesting experiment is illustrated in Fig. 2. The word "Kemex" is printed on cardboard, using the solution of Tannic Acid as ink. The card is then brushed over with a solution of Iron Alum, with the result that the print immediately becomes visible. (*Continued on page 996*)

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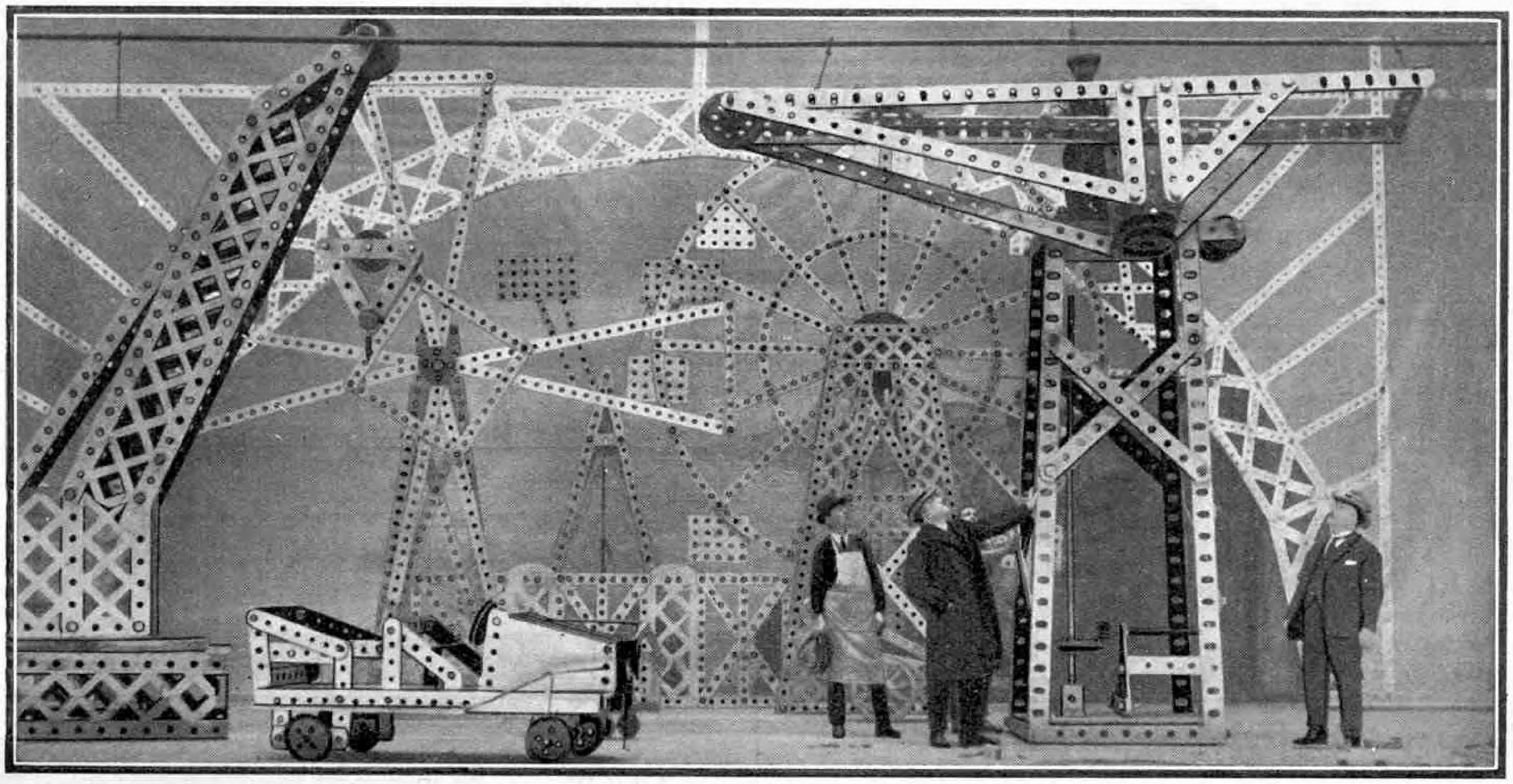
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Meccanoland in Edinburgh

Giant Working Models in Pantomime



MANY years ago Mr. Julian Wylie, most famous of pantomime producers, was making plans for the approaching pantomime season and searching for a novel idea for a scene in one of his productions. Suddenly he thought of Meccano, and immediately there flashed across his mind the vision of a Meccano scene, in which the central feature should be Meccano models of gigantic size, all working and surrounded by a host of real Meccano boys. The idea was quickly developed, and huge Meccano parts, each designed exactly on the lines of the originals were constructed by his enthusiastic staff, and models of enormous size were assembled on the stage. The effect surpassed all expectations, and the success of the scene was assured.

Meccanoland first made its appearance in the pantomime "*The Sleeping Beauty*," at the Empire Theatre, Liverpool, in the 1926–7 season. It aroused tremendous enthusiasm at every performance, and was immensely popular with young and old alike. Its success was repeated two years later at Drury Lane Theatre, the famous London home of pantomime, and this year it is to appear at the King's Theatre, Edinburgh, where "*The Sleeping Beauty*" is to be presented for a season, commencing on 16th December. The part of the Queen will be played by G. S. Melvin and that of the Prince by Miss Alma Barnes.

One of the chief reasons for the great popularity of Mr. Wylie's innovation is the intense realism of Meccano, which is true engineering in miniature. This has been borne in mind in planning the giant models which are the main feature of the scene. These include a monster aeroplane that flies, a motor car, a windmill, a huge hammerhead crane, and a variety of motor cars, trucks and other smaller models, all working. The models are exact large scale copies of the corresponding Meccano models, except that the parts are made of wood instead of steel. Wood is used on account of its lightness, for it will readily be understood that steel parts of this enormous size would require giant cranes to handle them. They are finished in aluminium paint and in the intensely brilliant stage lighting they look exactly like highly polished steel. In order to ensure absolute accuracy, each model was first built in Meccano to provide a pattern for the enlarged version seen on the stage.

The photograph above shows the giant models for the Meccanoland Scene in course of construction. The presence of the men on the stage gives a splendid idea of the immense size of these great models, all of which are exact large-scale copies of the corresponding Meccano models, except that the parts are made of wood instead of steel. The models are coated with aluminium paint, which gives them a polished steel-like finish.

The Meccano scene is planned on gorgeous lines, and over everything there is a wonderful glow of light from banks of lamps with a total of thousands of candle power. The immense switchboard from which the lighting of the theatre is controlled is fitted with every mechanism yet invented. The operator in charge is able by manipulating switches to vary his lighting effects with almost startling rapidity, and to blend lights of every colour and intensity into the most wonderful combinations. The models themselves are all working energetically, and in addition the stage is occupied by Meccano boys, easily distinguished by their regulation jerseys, and by a chorus wearing unique head-gear, each member's hat being crowned by a different Meccano model in miniature.

This scene alone is worth a long journey to see, and I can assure all Meccano boys that they will be fascinated. The pantomime is not merely an affair of costumes, songs and dances, but is, in fact, a great feat in engineering.

Mr. Wylie, who is himself a Meccano enthusiast, has probably been responsible for a larger number of successful entertainments than any other living producer. His work in connection with pantomimes must have been stupendous, for he has seldom been content to produce one at a time, and on several occasions has guided the fortunes of five at once, two of them as far apart as Glasgow and London.

Meccanoland has also figured in other Julian Wylie pantomimes. Its first appearance on any stage was in "*Babes in the Wood*" at the Palace Theatre, Manchester in December, 1917, when it was an instant success. In 1931 it was featured in the pantomime "*Dick Whittington*," at the Theatre Royal, Glasgow.

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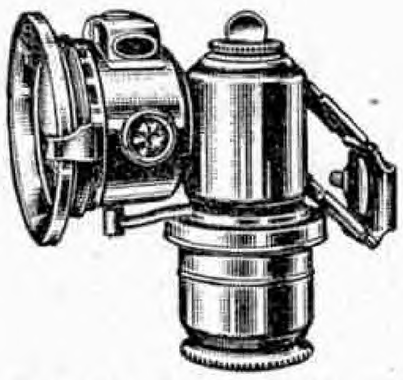
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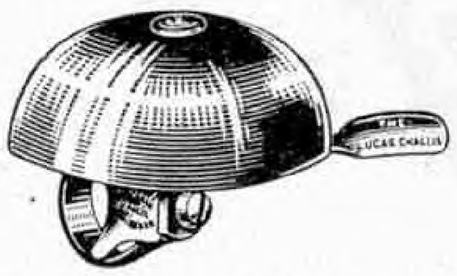
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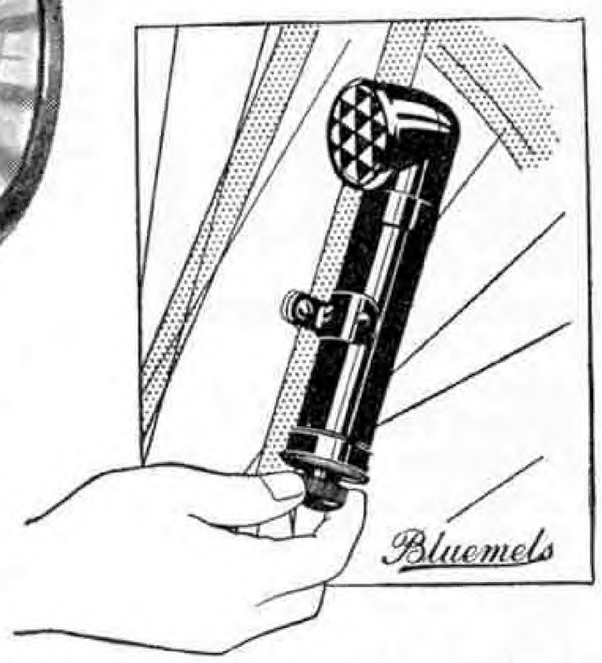
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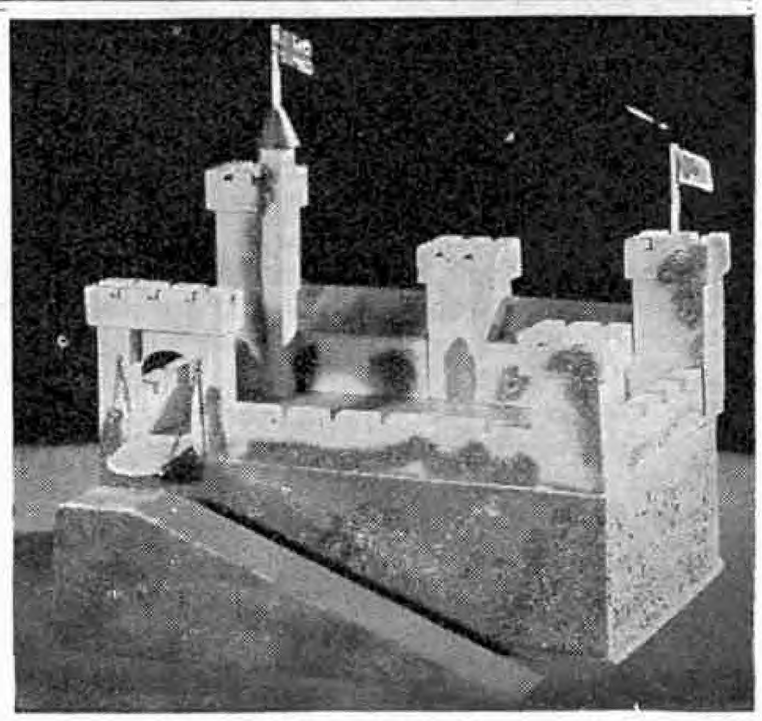
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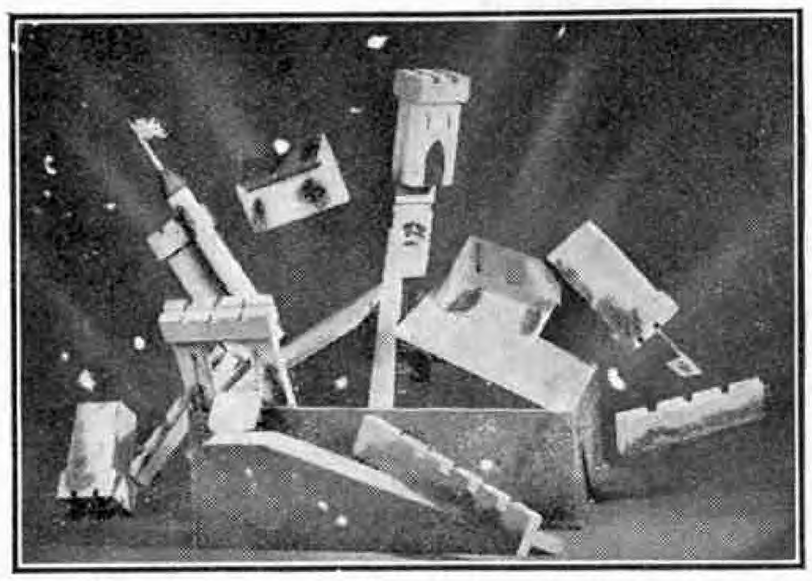
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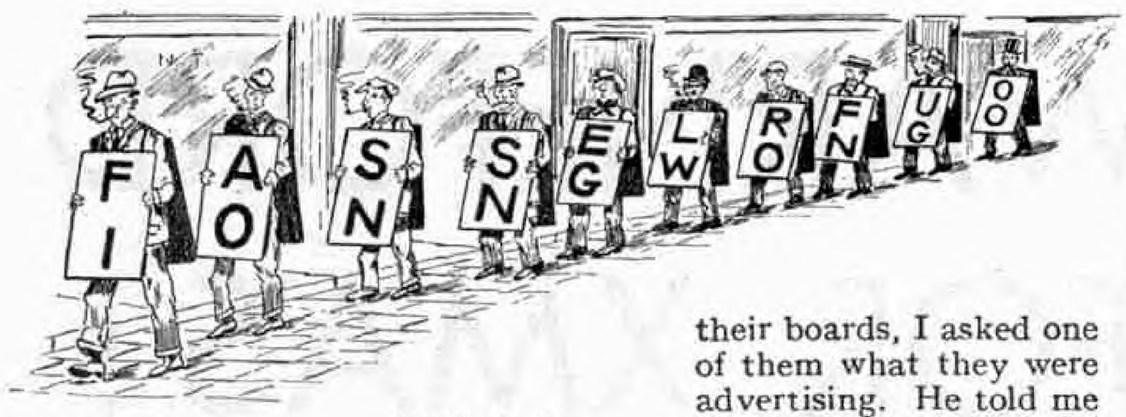
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Puzzle No. 1

When out the other day I saw 10 sandwich men going along in the order shown below. As I was unable to decipher the message on



Puzzle No. 1.

their boards, I asked one of them what they were advertising. He told me that they had just re-assembled after their mid-day meal, and had not yet sorted themselves out.

Can you re-arrange the men so that the letters on their boards form a message? It reads along the top of the boards and then along the bottom.

Puzzle No. 2

In the following sentence a well-known proverb is hidden. What is it?

When at last it chased one of the boys into a nearby hut I merely tried to save some of the others who, even in eluding the angry bull, attempted to help their comrade.

Puzzle No. 3

Strike me if you will,
Treat me with disdain.
Burn me, break me, still
Your equal I remain.
What am I?

Puzzle No. 4

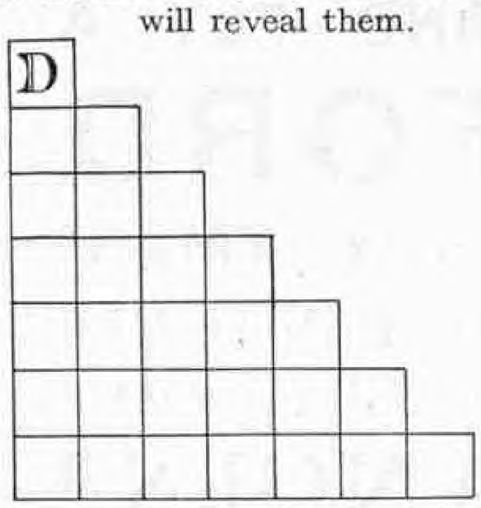
Sixteen Meccano parts are hidden in the square in the centre of this page. These may be found by starting at a certain square and following the King's move at chess, which is one square at a time in any direction. The first word begins in the top right-hand corner. Every letter in the square is used once.

I	S	T	T	I	W	E	M	S	T
P	R	T	H	R	V	O	R	R	C
A	R	C	L	A	B	N	U	R	E
B	I	E	R	O	O	N	I	W	D
R	O	L	H	I	N	E	V	R	G
E	K	O	O	S	R	T	T	E	N
T	I	O	N	P	E	L	U	I	S
N	N	P	R	A	F	E	C	H	H
G	R	I	K	P	N	O	R	L	G
C	A	N	S	N	A	U	P	N	I

Puzzle No. 4.

Puzzle No. 5

Can you convert the following combination of letters into an ordinary long division sum? Various clues to the identity of the numbers are hidden in the sum, and a careful observation will reveal them.



Puzzle No. 6.

BE)CDAG(IEF
FC
—
. HA
EA
—
BGG
AB
—
. . A
—

Puzzle No. 6

Beginning with the letter D and adding one letter at a time, fill in the squares in the diagram for this puzzle until a seven-letter word is obtained, which gives the name of an Irish seaport.

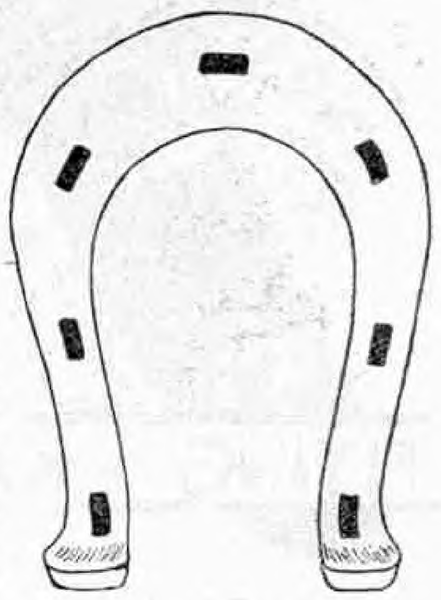
Puzzle No. 7

In the following four-line verse all the vowels have been left out. Fill these in and discover the verse.

Thwndflppdlsthwndwsstll,
Shkntddfrmthtrndhll:
hdwlkdntthwndswll,
stnwfrthwndwsstll.

Puzzle No. 8

How can the horseshoe shown in the upper right-hand corner be divided into seven pieces, each with a nail in it, with only two cuts of a pair of scissors? The cuts must be straight, but after the first one the pieces may be re-arranged if necessary.



Puzzle No. 8.

Puzzle No. 9

Fill in the squares and circles in the figure in the bottom right-hand corner of this page, placing consonants in the squares and vowels in the circles. When this has been done, the letters in the shaded vertical line form the name of a lady associated with apples. The clues, from the first line downward, are as follows:—

Incapacitate.
Disliked intensely.
What the man was who gave 6d. for 1d.
Pounds.
He—a book.
—Tube.
Most boys like this.
More than one aeroplane used by Imperial Airways.

Puzzle No. 10

Below are 10 words of jumbled letters. Each of these represents the name of some man well-known to boys. The names include aviators, footballers, explorers, etc. What are these names?

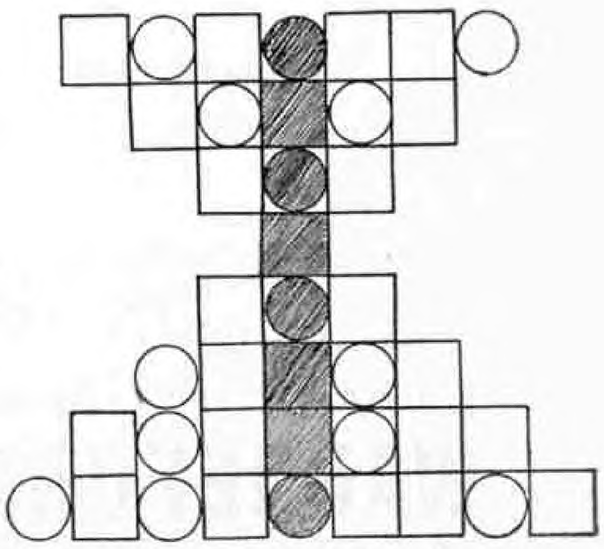
1. SGMHSTIDKONRIF
2. LNSOTHEKCA
3. CTOST
4. EFSFLUCTI
5. AFTWNOBAADUTAI
6. NSBITA
7. LSEERWLCS
8. ABOORRT
9. NATSIU
10. SOIMNLOL

Puzzle No. 11

What Meccano parts do the following definitions indicate?

1. To educate, and that which connects.
2. A domestic quadruped, and to seize.
3. If u were o, would be a thief, and a circle.

(*For solutions turn to page 996*)



Puzzle No. 9.

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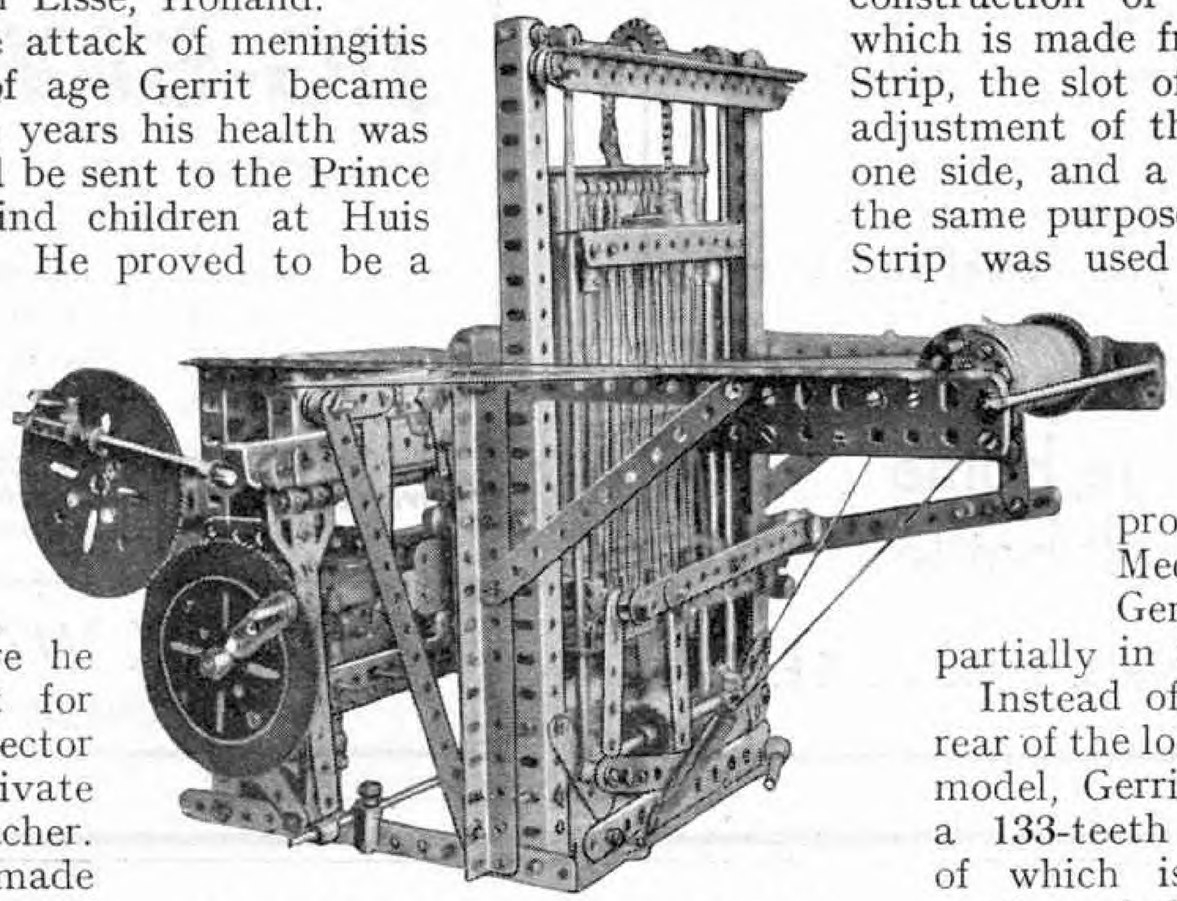


A Blind Boy's Great Achievement

A Wonderful Model Loom

THE fine model loom illustrated on this page is of exceptional interest, for it has been designed and built entirely by a blind boy, Gerrit van der Mey, of Lisse, Holland.

As the result of a severe attack of meningitis when he was five years of age Gerrit became totally blind. After three years his health was so far restored that he could be sent to the Prince Alexander Institute for blind children at Huis ter Heide, near Utrecht. He proved to be a bright scholar, and it took him only a few months to learn the Braille writing, which is of such enormous assistance to the blind. Subsequently he went to the Institute for the Blind in Amsterdam, where he showed such a great gift for mathematics that the Director arranged for him to have private lessons from a special teacher. With his sensitive fingers he made good progress in the study of geometry by the use of special models constructed for him in clay.

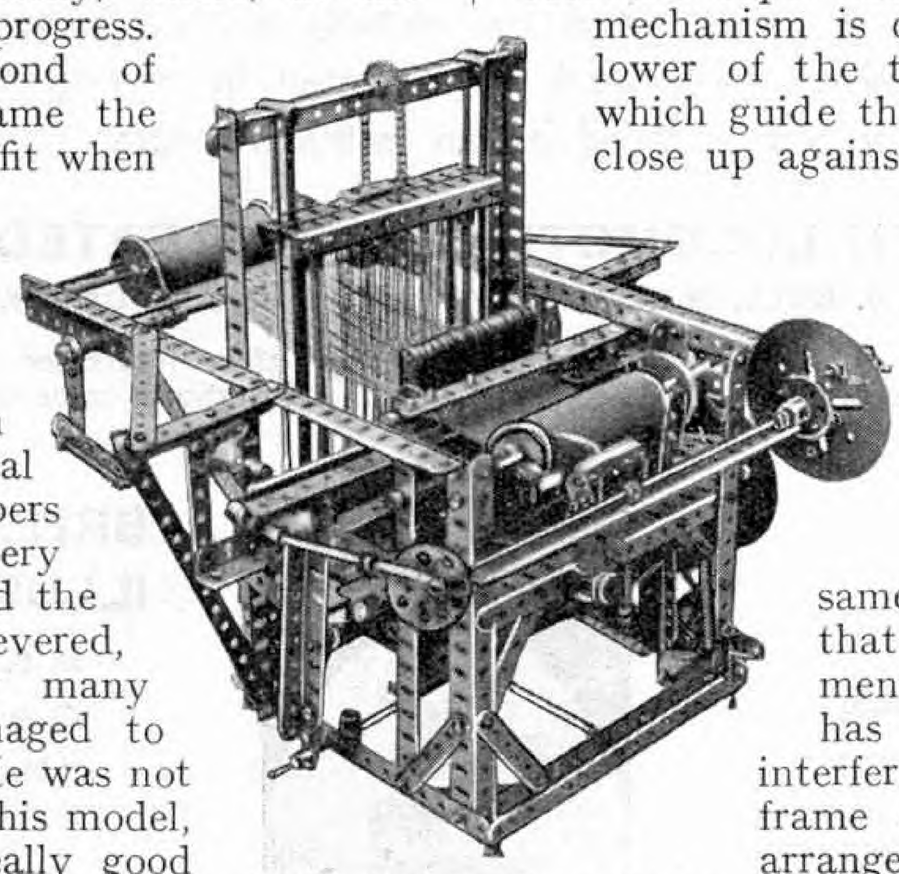


The Loom built by a blind Dutch boy, Gerrit van der Mey, whose portrait appears at the head of this page. It is interesting to compare this model with the standard Meccano Loom described in Super Model Instruction Leaflet No. 16A.

After learning German, Gerrit went to the College for the Blind at Marburg, Germany, where, at the age of 19, he is still making rapid progress.

Gerrit has always been fond of mechanical matters. He became the possessor of his first Meccanō Outfit when he was 10, and since then Meccano model-building has been his special hobby.

Four years ago he set out to build the Meccano Loom described in Super Model Instruction Leaflet No. 16a. The constructional details were read to him by members of his family, who gave him every possible assistance, but he found the task very difficult. He persevered, however, and eventually after many unsuccessful attempts he managed to complete quite a good model. He was not satisfied with the mechanism of this model, however, for the weaving of really good fabric caused him too many difficulties. He therefore set to work to incorporate various ideas of his own in the mechanism, and he devoted all his spare time to this task. Last year he succeeded in constructing the loom illustrated, which enabled him to weave long pieces of fabric without any faults and of beautiful texture.



A front view of the Loom showing finished cloth emerging from the machine.

The model is built entirely of Meccano parts but, as will be seen from the illustrations, the framework and the mechanism differ in many respects from the standard Meccano model.

One of the chief differences is to be seen in the construction of the slay, the channel of which is made from an Angle Girder and a Strip, the slot of the Angle Girder allowing adjustment of the depth of the channel on one side, and a Rack Strip being used for the same purpose on the other. The Rack Strip was used because this part is the only strip-like piece, apart from the Angle Girders and Flat Girders, that has a transverse slot. The slay and reeds are a prominent feature of the Meccano super model, but in Gerrit's model they are hidden partially in the framework.

Instead of taking the drive from the rear of the loom as is done in the standard model, Gerrit has placed the handle on a 133-teeth Gear Wheel, the spindle of which is journalled in the front portion of the main frame. There are two of these Gear Wheels in mesh with each other, and the upper one drives the "picking" mechanism by means of Cranks and Rods. This is another departure from the Meccano super model, for in the latter the picking mechanism is operated by means of cords. The lower of the two Gears drives the reed frames, which guide the warps and push the weft threads close up against each other.

In the standard model Loom the finished material is wound on a Wood Roller after passing over a Sand Roller, the varying diameter of the roll being accommodated by means of Tension Springs and Hooks. The boy's model has only one Roller, however, and this is placed on the same level as the slay. I do not think that this can be considered an improvement, for when a large roll of cloth has accumulated it will be liable to interfere with the working of the reed frame and shuttle. Nevertheless this arrangement facilitates removal of the finished material, and provided that only small rolls are made at a time, it should not cause serious difficulty.

The frames slide on guide Rods, which permit them to move in a vertical direction only and also eliminate all side play.

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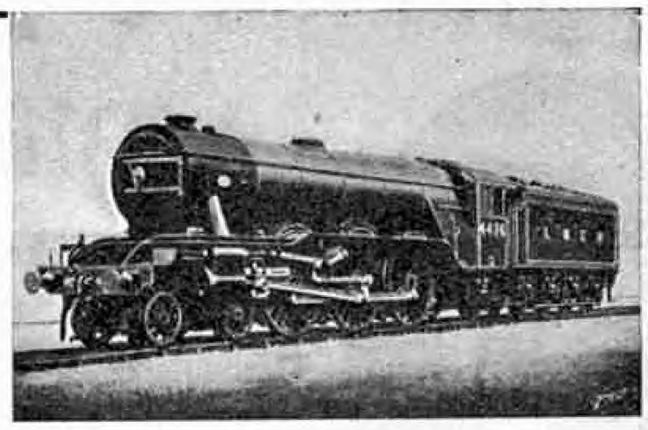
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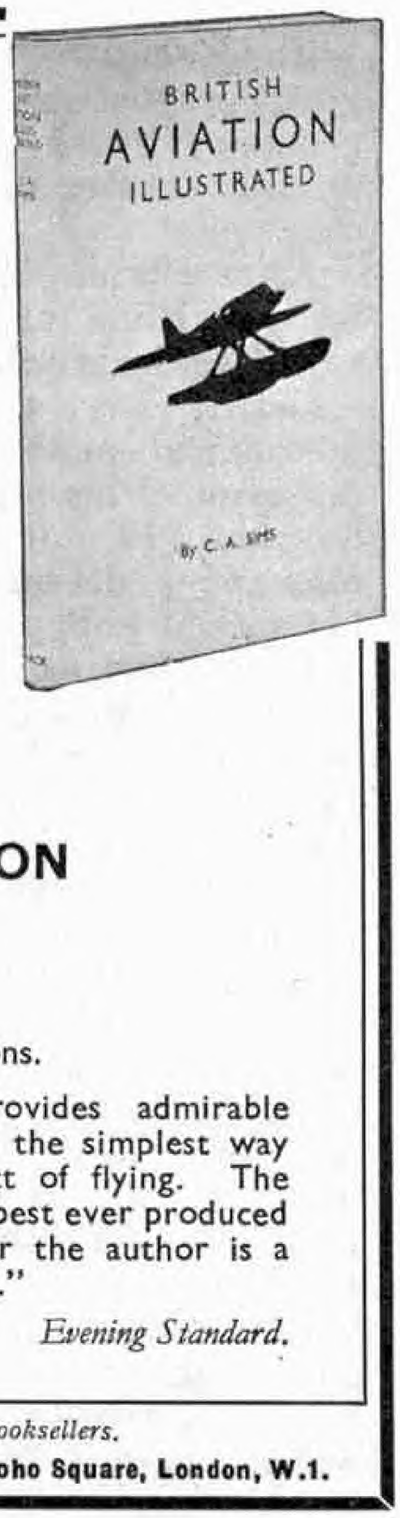
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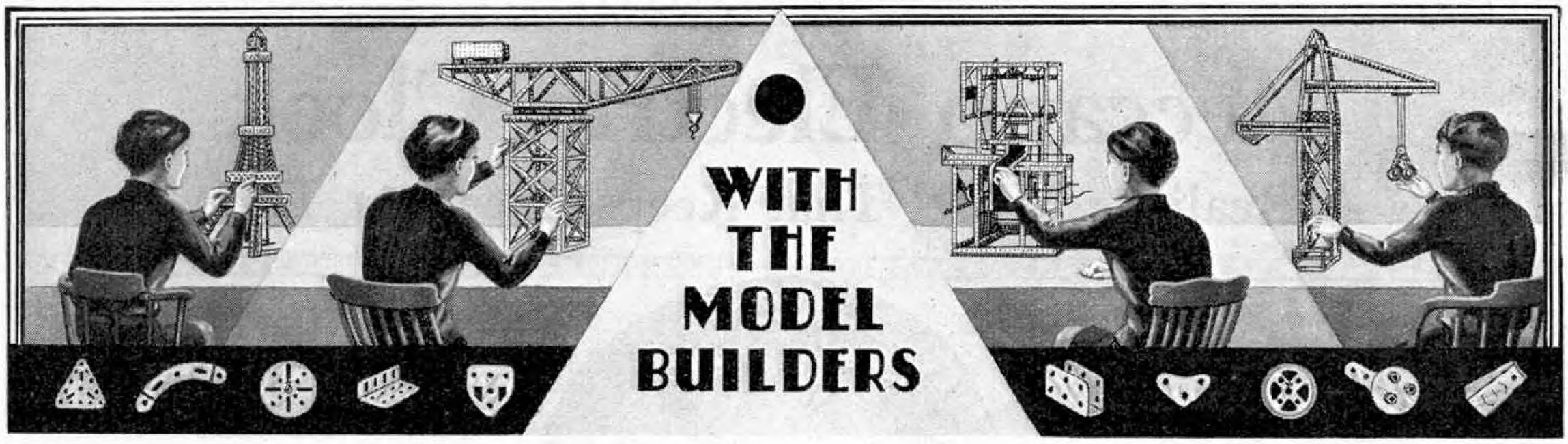
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MAKING USE OF THE SOCKET COUPLING

The Socket Coupling (Part No. 171) is designed for coupling together two Wheels or Gears so that the two parts rotate as one unit, but are free to slide on the Axle Rod. The part is extremely useful in gear-box construction, and may be employed for securing together the bosses of two Pinions or Gears, or for coupling a Gear to one section of a Dog Clutch or friction clutch. The selector groove in the centre of a Socket Coupling is for controlling its sliding movement, and the longitudinal slots enable parts to be gripped in position without removing the Set Screws or Grub Screws. In securing two parts together by this means, care should be taken to see that they are in proper alignment so that the complete unit slides freely on the Axle Rod. The two parts may be coupled together securely yet allowed a certain amount of freedom of movement if the Set Screws or Grub Screws are removed, and the Grub Screws in the Socket Coupling screwed down so that they fit into the opposite tapped bores of the Wheel bosses. This ensures that the parts rotate " solid," but the Grub Screws allow a certain amount of freedom so that there is no need to line up the bosses in assembling.

A NEAT SLIDING UNIT

The Socket Coupling may be used to advantage for the friction clutch of a model car. In this case it is required to slide one of the clutch members to disengage the frictional surfaces, but the sliding member must rotate " solid " with the shaft carrying it. This may be achieved by mounting a Collar on the Rod, and gripping it tightly in position by means of a Set Screw. A Socket Coupling is arranged so that the Set Screw slides in one of the slots, but a Compression Spring cut down to about 1/3rd normal length is inserted between the Coupling and the Collar. The Socket Coupling carries a 1" Pulley, and a ½" loose Pulley fitted with a ⅜" Rubber Ring is free on the Rod. A 1½" Contrate driven from the engine is also free on the Rod, but is held in engagement with its Pinion by means of a fixed Collar. Normally the Compression Spring presses the Pulley against the Rubber Ring, which in turn is held in close contact with the Contrate. The Set Screw in the Collar prevents the Socket Coupling unit from rotating independently of the Rod, although it is free to slide. The clutch may be withdrawn by arranging a Rod so that it engages the groove in the Socket Coupling, and connecting it up in a suitable manner to the foot pedal.

BALL AND SOCKET

A neat ball and socket can be made from a Socket Coupling and Handrail Support. The rounded part of the Handrail Support with Grub Screw removed fits into the Socket Coupling and is free to swivel universally. Instead of the Handrail Support the new Handrail Coupling may be used, and in many cases this will be found more useful, as it can be fitted with an Axle Rod. A ball and socket built up in this way can be used only when the two parts are held continually in contact with each other. An alternative is to employ a Universal Coupling, and each method will be found to have certain advantages for different types of models.

MINIATURE SHIPS' FITTINGS

Ship building is a very fascinating branch of model construction, and the many different subjects available for reproduction offer plenty of scope for ingenuity and originality. No matter what type of vessel it is decided to build, it is sure to provide plenty of opportunity for detail work, and the various deck fittings and accessories, which are usually fairly small in comparison with the size of the ship, will require a little careful thought if they are to be reproduced with realism. The appearance of the model will depend to a large extent upon the amount of detail incorporated, and such work includes the fitting of hatch covers, winches, derricks, boat davits, life boats, etc. It is the smaller details, however, that give the model a distinctive appearance and add a note of realism. Such items as bollards, capstans, syrens, ventilators, anchors, etc., are likely to present difficulty on account of their small size. For these accessories Meccano parts such as Couplings, Collars, Handrail Supports and Buffers are extremely useful, and even nuts, bolts and Washers can often be used to advantage for completing small detail work. Where rodding is required, Screwed Rods are often more convenient than ordinary Axle Rods as they can be fixed in position by two nuts only.

Meccano Electrical Parts Revisions

Model builders should note the following revisions to the range of Meccano Electrical Parts Nos. 301-315, which will no longer be listed separately as Meccano Electrical Parts.

The following parts are now included in the standard Meccano range, the new numbers being as follows:—

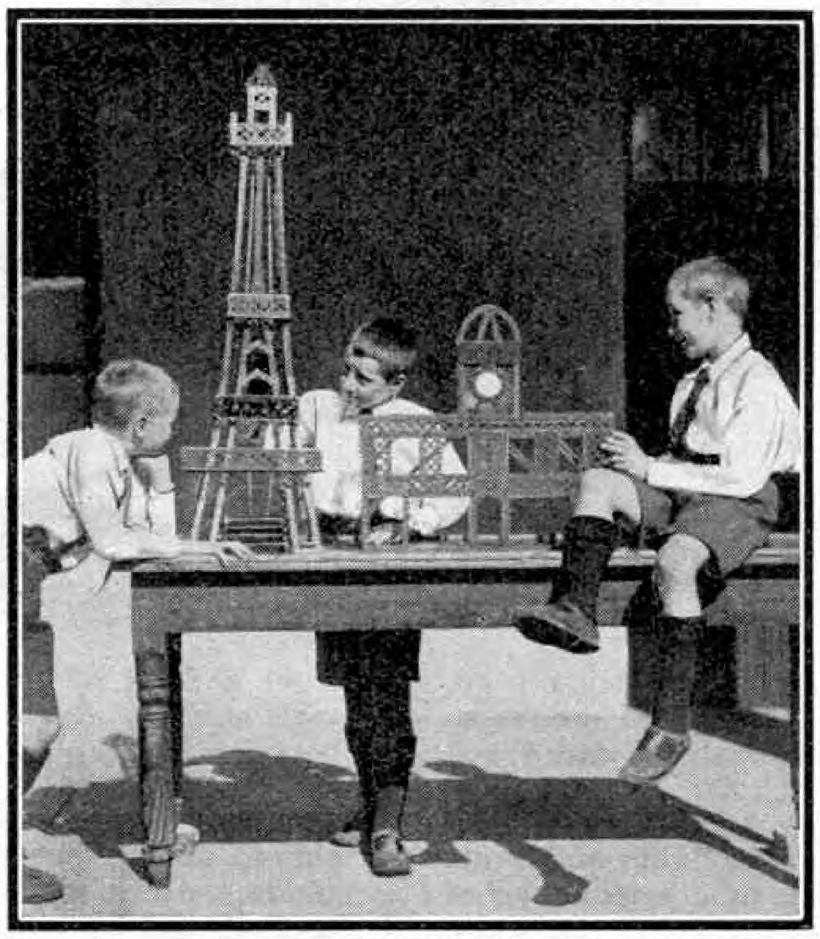
Old No. 301,	**Bobbin ... ...**	**now No. 181**
„ 302,	**Insulating Bush ... ...**	**„ 182**
„ 310,	**Lamp Holder ... ...**	**„ 183**
„ 311,	**Lamp (6-volt) ... ...**	**„ 184**

The following parts are now included in the " Elektron " range, and are numbered as follows:—

Old No. 303,	**Insulating Washer ... ...**	**now No. 1570**
„ 304,	**6 B.A. Screws ... ...**	**„ 1575**
„ 305,	**6 B.A. Nuts ... ...**	**„ 1583**
„ 306,	**Terminal ... ...**	**„ 1563**
„ 307,	**Silver-tipped Contact Screw**	**„ 1569**
„ 313,	**26-G. S.C.C. Copper Wire ...**	**„ 1586**
„ 314,	**23-G. S.C.C. Copper Wire ...**	**„ 1587**

The parts listed below, which have limited uses, are no longer included in the system:—

No. 308, Core or Pole Piece.
„ 309, Coil Check.
„ 312, 27 Gauge Bare Iron Wire.
„ 315, 22 Gauge Bare Copper Wire.



Boys from the Emerald Hill Orphanage, Salisbury, Southern Rhodesia, are keen model builders, and this illustration shows three enthusiasts adding the finishing touches to their models. The model Eiffel Tower on the left is fitted with two working lift cages.

SMALL CAPSTANS

Capstans suitable for use on a small-scale model can be reproduced in a very realistic manner by using the terminals from a No. E6 Electric Motor. These should be mounted on the deck by means of ordinary bolts. The terminals from the Elektron Outfit may be used as a substitute for the Electric Motor terminals, but they are not so realistic. They make excellent bollards, however. A slightly larger capstan can be represented by a Buffer, Part No. 120, and an even larger accessory can be made by removing the Compression Spring from a Spring Buffer so that the shank fits close down into the sleeve, under which a ½" Loose Pulley is placed before passing the shank through the deck and fitting it with a nut for holding it down.

WARSHIP FITTINGS

Warships differ considerably from merchant vessels and call for an entirely different range of fittings. Torpedo tubes can be made from Couplings mounted on Axle Rods passed through 1" Triangular Plates. The complete set of three should be mounted on a swivel. Small anti-aircraft guns can be made by fitting a short Axle Rod in a Coupling pivotally mounted in a small Fork Piece. The Fork Piece should also be free to pivot on the deck, and this may be achieved by inserting a bolt through the deck and gripping the shank in the boss of the Fork Piece, allowing sufficient play for free movement.

Very realistic depth charges of approximately scale size for the average model, can be represented by the Lamp Holders, Part No. 183. These should be appropriately mounted in slings or on trolleys at the stern of the vessel.

Small items that should not be overlooked on model warships are the air vents, which take the place of the ventilators that are such a prominent feature on passenger and cargo ships. The air vents may be made by mounting ⅜" Bolts with the shanks uppermost, and fitting a Collar on the end of each.

Small searchlights that can be used on almost any type of vessel, and for a large number of other models, can be made from Chimney Adapters, clamped between small Fork Pieces the ends of which are opened out slightly. Lamp Holders can also be used and mounted in a similar manner. These searchlights may be illuminated by fitting one of the small pea-lamps from the Meccano Motor Car Lighting Set. The lamps are supplied wired together in pairs and should be separated for this purpose. The flex should be threaded through the hole at the back of the searchlight, and it will be found that the insulating sleeve immediately behind the lamp fits tightly in the hole and retains the lamp in position.

ILLUMINATING MODELS

The pea-lamps can be put to a large number of useful purposes, and can be employed in many cases where the ordinary Lamps and Lamp Holders are too large. They will be found useful for lighting up the interiors of tramcars, motor buses, railway coaches, etc., and for accessories such as motor car head-lamps and side-lamps. For these the bulbs should be fitted in the bosses of the Flanged Wheels forming the lamps, which are fixed in position by means of Screwed Rods or long bolts inserted in the tapped bores.

A small colour-light railway signal or an automatic traffic signal can be made from Chimney Adapters or Lamp Holders in which pea-lamps are inserted and coloured with a translucent paint. Celluloid may be used instead of paint, or even tissue paper dipped in red, green or blue ink. Signals built up in this way are more in keeping with the scale of Hornby Locomotives or Meccano Motor Cars than larger signals built to accommodate the standard Lamps and Holders.

The pea-lamps may be retained in place in any standard perforation by pushing an Insulating Washer (Elektron Part No. 1570) over the insulating sleeve after it has been passed through the Strip or Plate.

Meccano Electric Clock

A Realistic Model That Keeps Excellent Time

CLOCKS are among the most popular models with Meccano enthusiasts. The fine Grandfather Clock described in Super Model Leaflet No. 14A is a special favourite, not only on account of its interesting construction, but also because of its excellent timekeeping qualities. Another attractive model is the Mantel Clock No. 7.13, which keeps good time, but has to be wound up every four hours. In this article we describe another Mantel Clock that is not only a much finer model in design, construction, and general appearance, but, being electrically driven, does not require to be wound up at all.

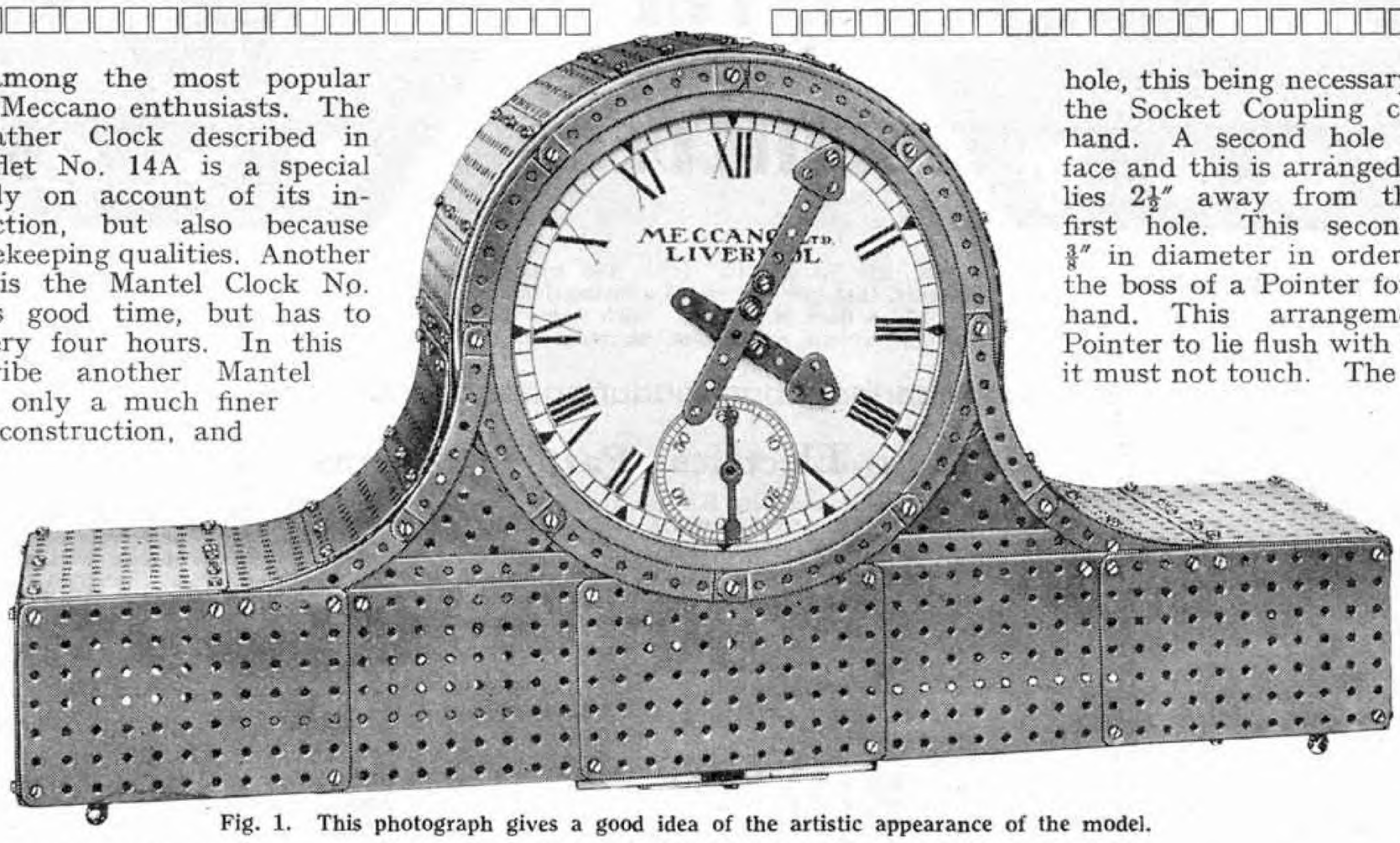


Fig. 1. This photograph gives a good idea of the artistic appearance of the model.

Construction of the Model

The base of the clock should first be constructed. The front and back each consists of a $24\frac{1}{2}''$ Angle Girder, the front one of which carries five $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates and the rear one four similar Plates. The Plates at the rear are arranged as shown in Fig. 2. When the front and rear are complete they are connected together by $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates held in place by means of $3\frac{1}{2}''$ Angle Girders and strengthened with the aid of $5\frac{1}{2}''$ Angle Girders. The structure is made rigid by fitting four $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, one being placed at each upper and lower end. At this stage the four Handrail Supports, forming the legs may also be fitted, these being shown clearly in Figs. 1 and 2.

The circular portion of the clock consists mainly of two Ring Frames (Part No. 167b), and these are fitted one to the front and one to the rear of the base. One Nut and Bolt is sufficient for the front Ring Frame, for the time being. The other Ring Frame must be secured temporarily in place by filling up the space at the rear of the base by means of a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate. Each Ring Frame is now fitted with a circle of 4" Curved Strips as shown in the illustrations, the Curved Strips on the front of the model being held in place by means of $\frac{3}{8}''$ Bolts. These Bolts will be used later for securing the clock face in place. Two extra Curved Strips 1 are also fitted to each side of the Ring Frames, and the spaces so formed are filled in by means of $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates 2 and 4 and $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates 3.

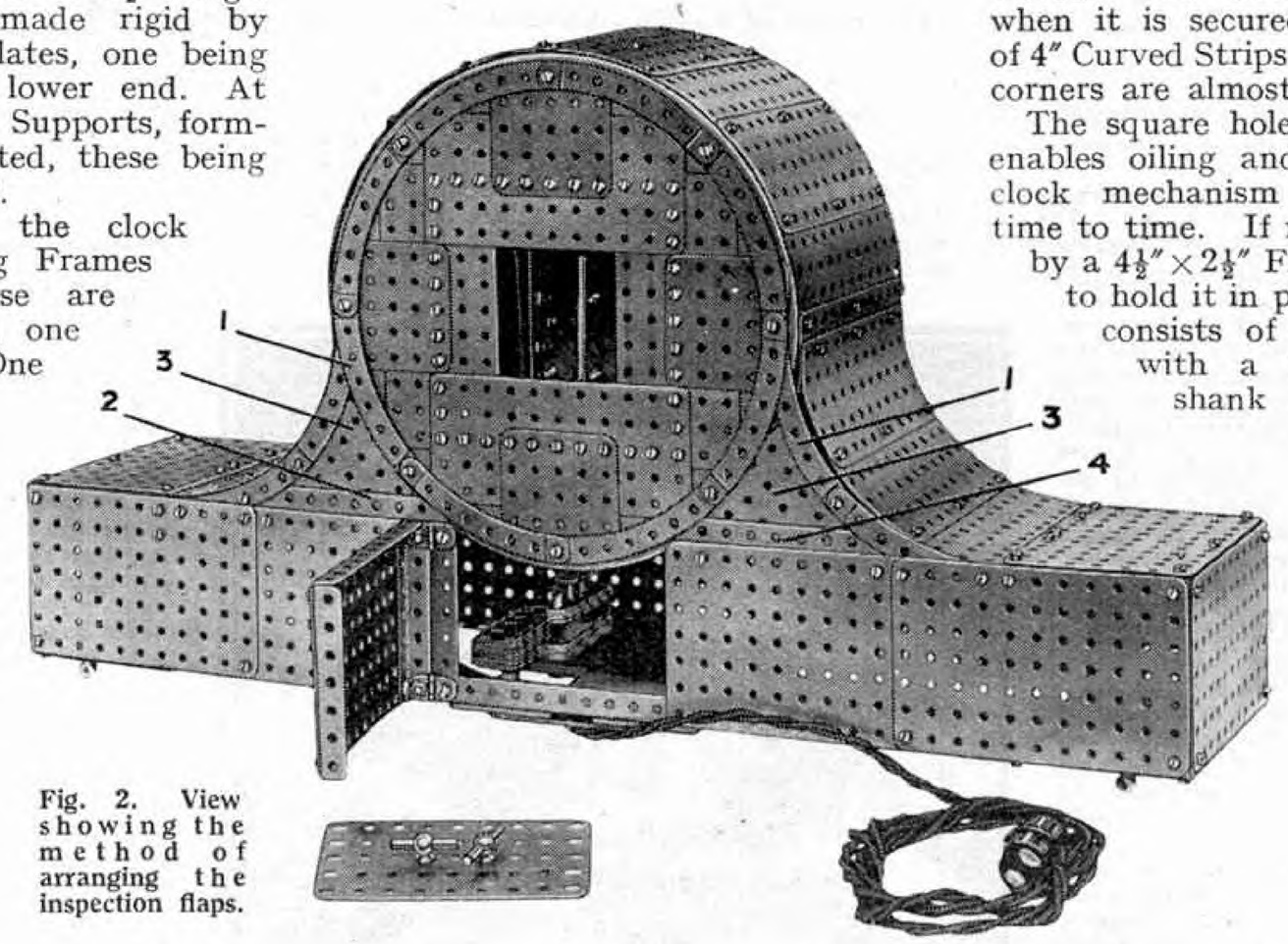


Fig. 2. View showing the method of arranging the inspection flaps.

Before proceeding any further, the clock face and also the back of the case must be fitted, for the securing Nuts and Bolts of these will be very difficult to manipulate at a later stage of the construction. The face consists of a stout piece of white cardboard $9\frac{1}{4}''$ in diameter, and round the periphery of this are punched eight 11/64" diameter holes, so arranged that they are coincident with the eight holes in the wide flange of the Ring Frame. The centre of the face is pierced with a $\frac{3}{4}''$ diameter hole, this being necessary to accommodate the Socket Coupling carrying the hour hand. A second hole is drilled in the face and this is arranged so that its centre lies $2\frac{1}{2}''$ away from the centre of the first hole. This second hole is made $\frac{3}{8}''$ in diameter in order to accommodate the boss of a Pointer forming the seconds hand. This arrangement allows the Pointer to lie flush with the face, although it must not touch. The requisite numbers and minute spaces may now be drawn in on the board, a neat arrangement being shown in Fig. 1. The complete face is held in place, as already described, by means of eight $\frac{3}{8}''$ Bolts arranged round the wide flange of the Ring Frame.

The back of the clock case is best constructed separately and then bolted in place. Four $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are first arranged to form a square, each Plate overlapping its neighbour three holes. Fig. 2 makes the arrangement quite clear. Four $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are then bolted in place as illustrated. The back is now completed and when it is secured in place, with the circle of 4" Curved Strips round its edge, the unsightly corners are almost completely hidden.

The square hole in the centre of the back enables oiling and slight adjustment of the clock mechanism to be carried out from time to time. If necessary it may be covered by a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, fitted with catches to hold it in place. Each of these catches consists of a Handrail Support fitted with a 1" Rod on the threaded shank of which a $1\frac{1}{2}''$ Strip is locked by means of two Nuts. On turning the Handrail Supports the $1\frac{1}{2}''$ Strips are made to grip behind the edges of the square hole in the back of the clock.

The $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate, mentioned earlier, that was fitted temporarily in order to support the rear Ring Frame, may now be removed and a hinged flap fitted in its place. This flap is built up from a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate strengthened on three of its edges with suitable Angle Girders. Two Hinges form the connection between the flap and the clock case.

The space between the two Ring Frames may now be filled in. This is accomplished with the aid of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates curved slightly in order to fit neatly in their allotted places. The plating, which is best started from the top, is not bolted securely in place until all the Plates are in position. By this means the forcing of Bolts into holes is avoided.

The frame is now complete and the construction of the mechanism may next be undertaken. For this, Figs. 4 and 6 will be found useful. Two $18\frac{1}{2}''$ Angle Girders 6, connected together

by means of two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates, form a platform on which the vertical structure, carrying the gear train is built. Each side of this structure consists of two $9\frac{1}{2}''$ Angle Girders 7 supporting two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates overlapping each other three holes. The two sides, when complete, are joined together by two $3\frac{1}{2}''$ Strips, these being placed $2\frac{1}{2}''$ from the top of each side member. Four $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets 21 are now bolted in place as shown in Fig. 6, and the purpose of these will be described later. Two $1\frac{1}{2}''$ Strips 24 are also fitted, as illustrated, these being bolted in place on what will be the rear half of the gear train support. The Threaded Pin 29 may also be secured in place at this stage. This is required for keeping one of the wires clear of the mechanism at a later stage of the construction.

The framework is also fitted with extra bearings, and these are built up in the following way. The first bearing consists of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip that is supported at each end by a Simple Bell Crank, one of which is shown at 8. A third Simple Bell Crank 9 is also fitted, as shown in the illustration, and this carries a 2″ Strip 10 and a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket 11. The 2″ Strip 10 overlaps its Bell Crank 9 by three holes.

The gear train may now be fitted. A Crank 12, carried on a 3″ Rod in the top centre holes of the framework, is fitted with a Pawl, loosely mounted on a Pivot Bolt. This Pawl engages with a Ratchet Wheel secured on a 3″ Rod together with a 1″ Sprocket Wheel 13 that is connected by a length of Sprocket Chain to a second 1″ Sprocket Wheel. This latter Sprocket is mounted on a Rod together with a $\frac{1}{2}''$ Pinion, and this rotates a 57-teeth Gear Wheel that drives the seconds hand of the clock.

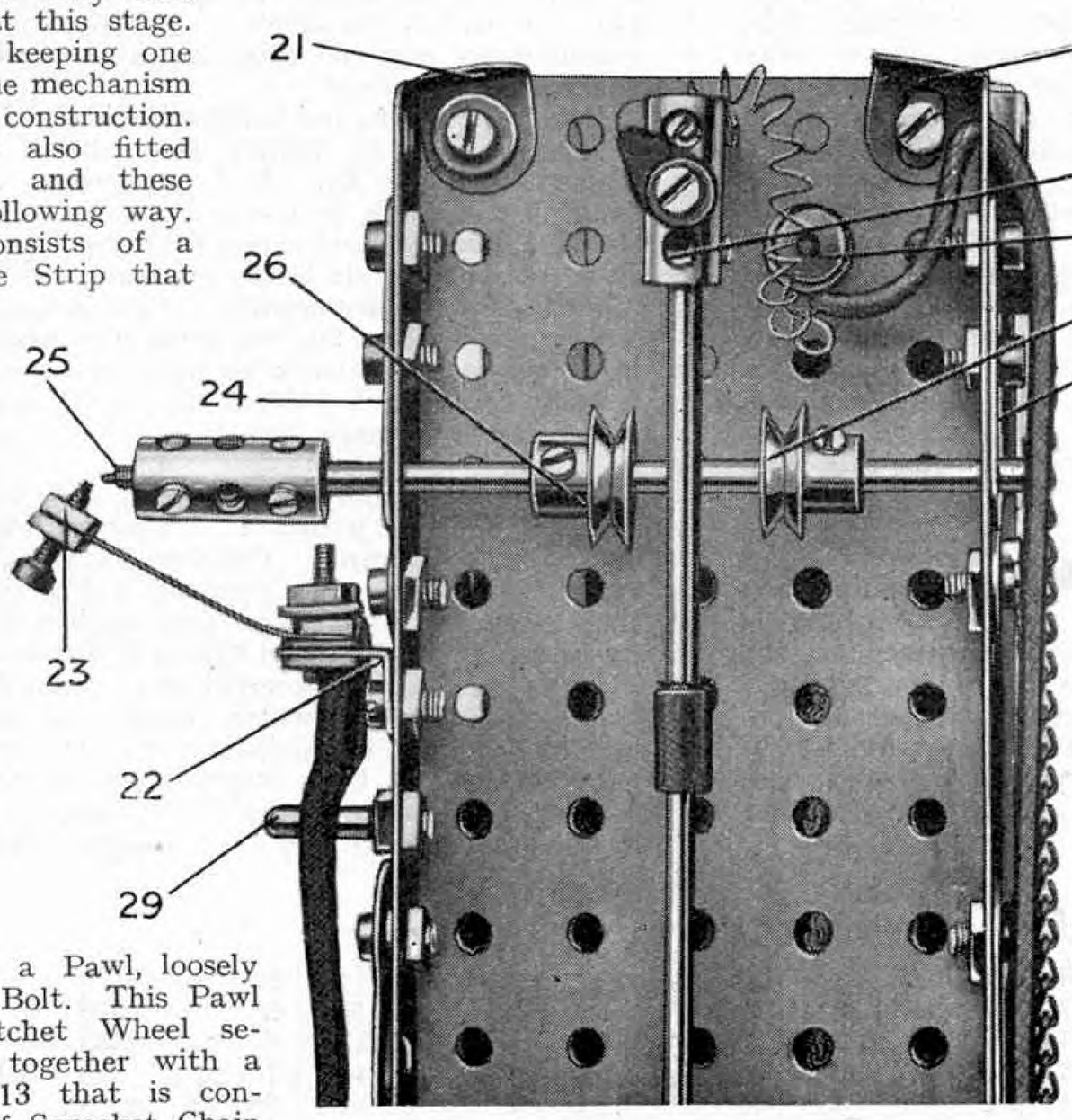


Fig. 4. The "brain" of the clock; view showing the automatic switchgear.

A $\frac{1}{2}''$ Pinion on the same Rod as the 57-teeth Gear Wheel 14 drives a second similar Gear on the 3″ Rod 15, a $\frac{3}{4}''$ Pinion also being carried on this Rod. This latter Pinion is in mesh with a 50-teeth Gear that is mounted on a 3″ Rod, together with a second $\frac{3}{4}''$ Pinion 16. A 50-teeth Gear in mesh with the Pinion 16 rotates, through the medium of a $\frac{1}{2}''$ Pinion, a $2\frac{1}{2}''$ Gear Wheel 17 that is gripped on the $4\frac{1}{2}''$ Rod 18. This Rod forms the shaft on which the minute hand of the clock is fastened, a $\frac{3}{4}''$ Pinion being carried in addition to the large Gear. A 50-teeth Gear and second $\frac{3}{4}''$ Pinion 19 is driven from this latter $\frac{3}{4}''$ Pinion, and the Pinion 19 rotates a second 50-teeth Gear operating two 1″ Gears, the second one of which rotates a $\frac{1}{2}''$ Pinion 22. This $\frac{1}{2}''$ Pinion is in mesh with a 57-teeth Gear Wheel that is free to rotate, together with a Socket Coupling, on the $4\frac{1}{2}''$ Rod 18. The open end of this Socket Coupling will later support the hour hand. It should be noted that the three 2″ Rods, carrying the gearing from the minute hand to the hour hand, are journalled at their inner ends in the bearings supported by the Simple Bell Cranks 8 and 9. This arrangement is necessary because of the $2\frac{1}{2}''$ Gear Wheel 17 covering the required holes in the rear member of the vertical framework.

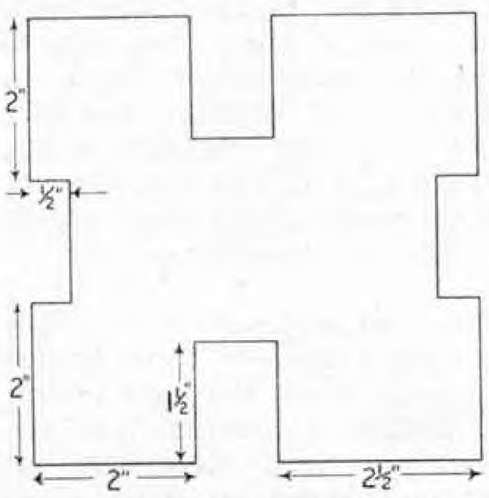


Fig. 3. Scale drawing of the board on which the horse-shoe magnet is mounted.

In order to prevent any mistakes occurring, the following gear ratio should exist between the various points. Between the 1″ Sprocket Wheel 13 and the seconds hand the ratio must be 3 : 1, and from this latter point to the Rod 18 it must be 60 : 1. From the Rod 18 to the Socket Coupling carrying the hour hand a ratio of 12 : 1 must exist.

The switch gear may now be fitted, and this is shown clearly in Fig. 4. The two $1\frac{1}{2}''$ Strips 24 mentioned earlier support a $3\frac{1}{2}''$ Rod in their lower holes. Two $\frac{1}{2}''$ fast Pulleys 26 are carried on this Rod and they may be secured temporarily in place, in the position shown in the illustration. They will be adjusted later when the pendulum is fitted. The Rod supporting these Pulleys also carries a Coupling, in the open end of which is gripped a Silver Tipped Contact Screw, the head having been removed previously. Two Grub Screws must be used for securing the Contact Screw in position.

The $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket 22 may now be bolted in place, and this carries a 6 B.A. Bolt insulated by an Insulating Bush and Washer and supporting a Pendulum Connection. The Pendulum Connection has a second hole, drilled in the opposite end to that already having one, to enable a Silver Tipped Contact Screw 23 to be carried, two 6 B.A. Nuts being used to hold this in place. This second Contact Screw must be so arranged that when the Rod carrying the Pulleys 26 slides in its bearings the Contact Screw 25 makes light sliding contact with it. Fig. 4 makes the arrangement quite clear.

The pendulum may now be built and fitted. A Coupling 27, secured on the Rod carrying the Crank 12, supports the upper end of an $11\frac{1}{2}''$ Rod the lower end of which is fitted with a Double Arm Crank 30. This Crank is gripped on the Rod $1\frac{1}{4}''$ from the lower end. The pendulum bob is built up from sixteen $2\frac{1}{2}''$ Strips and fifteen $1\frac{1}{2}''$ Strips They are arranged as illustrated in Fig. 7 and are clamped together by means of two 2″ Threaded Rods, one of which must be cut down to the required length on account of the restricted space inside the clock case. The Threaded Rod 31 carries a Nut that is used for raising or lowering the bob for the purpose of regulating the mechanism. The winding of the bob should be left until the horse-shoe magnet, shown in Fig. 5, is constructed.

The horse-shoe magnet is built up from Flat Girders as follows. Nine $5\frac{1}{2}''$ Flat Girders and eight $3\frac{1}{2}''$ Flat Girders are clamped together by means of $\frac{3}{4}''$ Bolts, so that the long and short Flat Girders are alternate. $2\frac{1}{2}''$ Flat Girders are then placed in each space between the $5\frac{1}{2}''$ Flat Girders, so that they form a square horse-shoe. All necessary securing is carried out with the aid of $\frac{3}{4}''$ Bolts. The spaces remaining between the protruding ends of the $2\frac{1}{2}''$ Flat Girders, may be filled in with $1\frac{1}{2}''$ Flat Girders as shown in Fig. 5.

In order to prevent magnetic leakage between the two poles of the magnet when the clock is working, the horse-shoe is mounted on a thin wooden base cut as shown in Fig. 3 in order that it may be accommodated easily in the model. Two 2″ Threaded Rods 4 and two $\frac{3}{4}''$ Bolts are used for securing the magnet to the board, the board then being clamped to the underside of the clock frame by means of the Strips 5. This arrangement is adopted in order to allow the horse-shoe magnet to be adjusted.

The model is now complete except for the wiring, and great care is necessary at this stage as the success of the model depends upon accurate work.

The bob of the pendulum

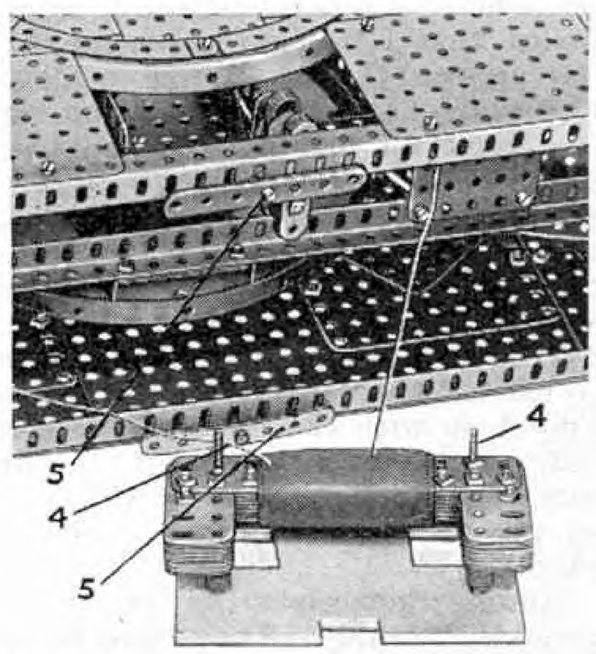


Fig. 5. The method of clamping the board carrying the magnet to the base of the model.

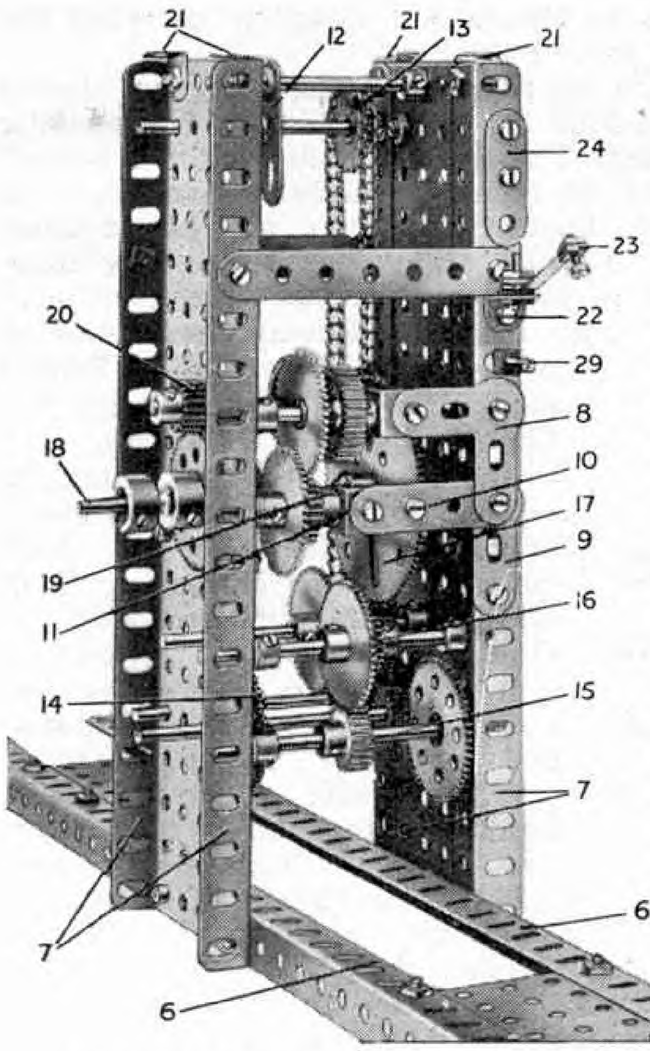


Fig. 6. The simple transmitting mechanism.

is wound in a clockwise direction when the 11½" Rod is held away from the person winding. A length of about 15 yd. of 35 S.W.G. S.C.C. wire is wound on this magnet, and care must be taken here, as in all other parts of the model, to use good insulating materials. The inner end of the wire must be earthed and the outer end attached to the Terminal 28 (Fig. 4). The horse-shoe magnet carries 80 yd. of 35 S.G.W. wire, and this must be wound on in a clockwise direction, when the open side of the magnet is on the right-hand side of the winder. The inner end of this wire is attached to one terminal of the transformer or accumulator, and the outer end is connected to the Terminal 28. The remaining terminal from the source of supply is connected to the insulated screw, carrying the contact 23.

The quantities of wire given are suitable for a current of 20V. If the only obtainable supply is of 6V., 24 yd. of 26 S.W.G. wire are required for the bob of the pendulum and 96 yd. of similar wire for the horse-shoe magnet.

The most suitable means of supplying current to this clock is the Meccano T20M Transformer, which may be incorporated in the base. Other types of Meccano 20V. Transformer also may be employed, but as they are larger, these will have to be placed outside the model. A Meccano T6M Transformer is suitable for the supply of current at 6V., and this may be incorporated in a similar manner to the T20M Transformer. Other Meccano 6V. Transformers may be used but cannot be accommodated within the model. A Meccano 6V. Accumulator may be used as an alternative to the Transformers.

Before fitting the mechanism in place, which is accomplished by bolting the ends of the Girders 6 inside the clock framework and securing the Angle Brackets 21 to the top of the clock case, it is best to adjust the mechanism, as it will be difficult to do so when it is surrounded by the framework. This is carried out by the Pulleys 26, the horse-shoe magnet being rigged up temporarily while adjustment is being carried out. When the mechanism is in position the hands (shown in Fig. 1) may be fitted.

The minute hand consists of a 5½" Strip, fitted at one end with a 1" Triangular Plate, and bolted to a Crank. This Crank is attached to the Strip three inches from the end carrying the Triangular Plate. The hour hand is built up from a 3½" Strip, fitted with a 1" Triangular Plate at one end, and mounted on a Double Arm Crank, the centre of which comes two and a half inches from the pointer end. The overhanging ends of both fingers may be fitted with small weights, formed from short Strips, in order to balance the 1" Triangular Plates.

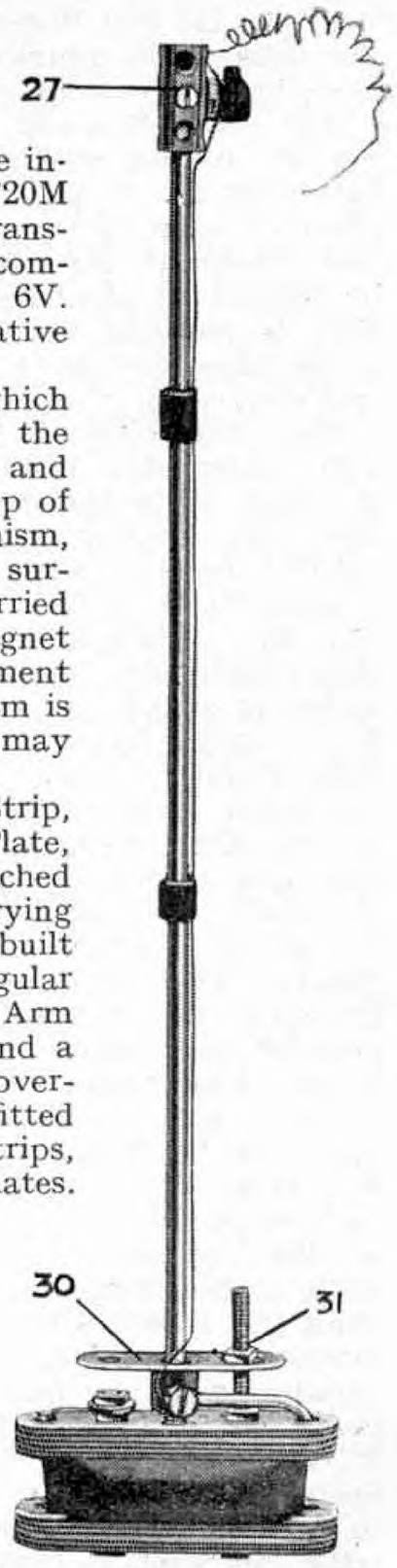


Fig. 7. The clock pendulum, showing how the "bob" is fitted.

The parts required to construct this model are:—

1	of No.	2	8	of No.	12	4	of No.	26	5	of No.	53a	16"	of No.	94	1 of No. 115
7	„ „	3	1	„ „	13	4	„ „	27	9	„ „	59	2	„ „	96	3 „ „ 127
16	„ „	5	1	„ „	15a	3	„ „	27a	3	„ „	62	9	„ „	103	6 „ „ 136
1	„ „	6	8	„ „	16	1	„ „	27c	1	„ „	62b	8	„ „	103d	1 „ „ 147
17	„ „	6a	1	„ „	16a	2	„ „	31	2	„ „	63	16	„ „	103f	1 „ „ 148
2	„ „	7	1	„ „	17	219	„ „	37	24	„ „	70	17	„ „	103h	1 „ „ 156
2	„ „	7a	1	„ „	18a	40	„ „	37a	10	„ „	72	10	„ „	111	2 „ „ 167b
4	„ „	8a	2	„ „	18b	57	„ „	38	2	„ „	77	2	„ „	111a	1 „ „ 171
3	„ „	9	2	„ „	23a	1	„ „	48a	4	„ „	81	10	„ „	111c	1 „ „ 172
10	„ „	9b	4	„ „	25	16	„ „	52a	24	„ „	89b	2	„ „	114	2 „ „ 182

2 of No. 1570
2 „ „ 1575
5 „ „ 1583
1 „ „ 1563
95 yd. of 35 S.W.G., S.C.C. Wire.
Piece of thin wood 5½" × 5½"

Grey Owl and His Friends—(*Cont. from page 931*)

gather that he seems to be subject to all the simpler emotions of which we as humans claim a monopoly, including to a marked degree those of gratitude and affection. And this is not mere "cupboard love" either, as with most domestic animals, as witness the case of the yearling beaver that I liberated from a trap and nursed his injured foot for nearly two weeks. Although he never before set eyes on a man, the poor creature, seeming to realise that I had saved his life, followed me around the camp like a dog, slept alongside of me at night, and on being set free took up his residence on the pond and is here yet, following my canoe up and down the lake and on occasion climbing into it. He shows his affection for me at times by climbing on to my knees and squeezing from his coat a pint or so of cold muddy water, mumbling contentedly to himself the while. A tame beaver that mated up with the newcomer will contest hotly with him for my attention, hustling him out into the lake if he should be first at my feet, and returning to take his place."

Among themselves the beaver are very sociable animals. They usually live in streams where, in order to render the water sufficiently deep, they build dams of mud and from the stems and boughs felled by their powerful jaws. In the neighbourhood of the dam they construct their lodges, which are roomy chambers, usually with two entrances from beneath the water. The mud that is used to cement the twigs together is plastered down by the front feet, and not, as sometimes supposed, by the tail, which is employed solely as a rudder.

In places that have been long frequented by beaver who have been left undisturbed, such as near Grey Owl's domain, their dams have become by frequent repairing a solid bank capable of resisting a great force of both ice and water. The materials used by the beaver in building the dams include driftwood, green willows, birch, poplars, and mud and stone. The stone and mud are mixed in such a manner as to contribute greatly to the strength of the dam. No particular engineering methods have ever been observed, however.

In building their houses the beaver use great care. These are formed of the same materials as the dam, and are constructed to house about eight to twelve animals. Some of the larger houses are built with partitions, forming apartments that have no communication with each other except under water. Beaver work very hard, are swift in their action, and always travel by water if able to do so.

In his effort to arouse public interest in the beaver Grey Owl discovered an unsuspected talent for writing. Already his articles, not only on the beaver, but on wild life in general, have been widely read, and his work is eagerly sought by magazines and journals. His work has awakened the interest of the Federal Government, and with his co-operation the Department of the Interior have been able to secure one of the most interesting moving pictures of beaver ever taken. These films depict the beaver at work in his natural surroundings, pictures his natural curiosity, and even show him eating out of hand. Recognising the value of his great knowledge of the wild, the Canadian Government have engaged the services of Grey Owl, who is now employed in conservation work in the National Parks in Western Canada.

We are indebted to the courtesy of the Canadian Department of the Interior for the information upon which this article is based and also for the illustrations.

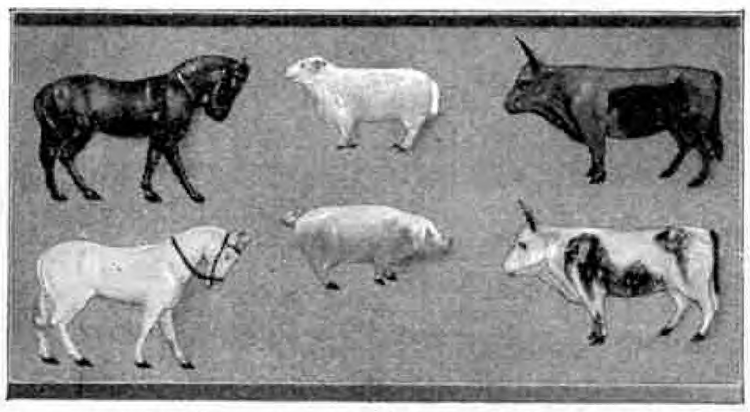
* * * * *

Readers who have enjoyed this article will be interested in a splendid contribution to our next issue, in which Mr. Jack Miner, the famous Canadian naturalist, tells the story of his great bird sanctuary at Kingsville, Ontario, the success of which has led to the provision by the Canadian Government of many similar bird sanctuaries.

New Modelled Miniatures Sets

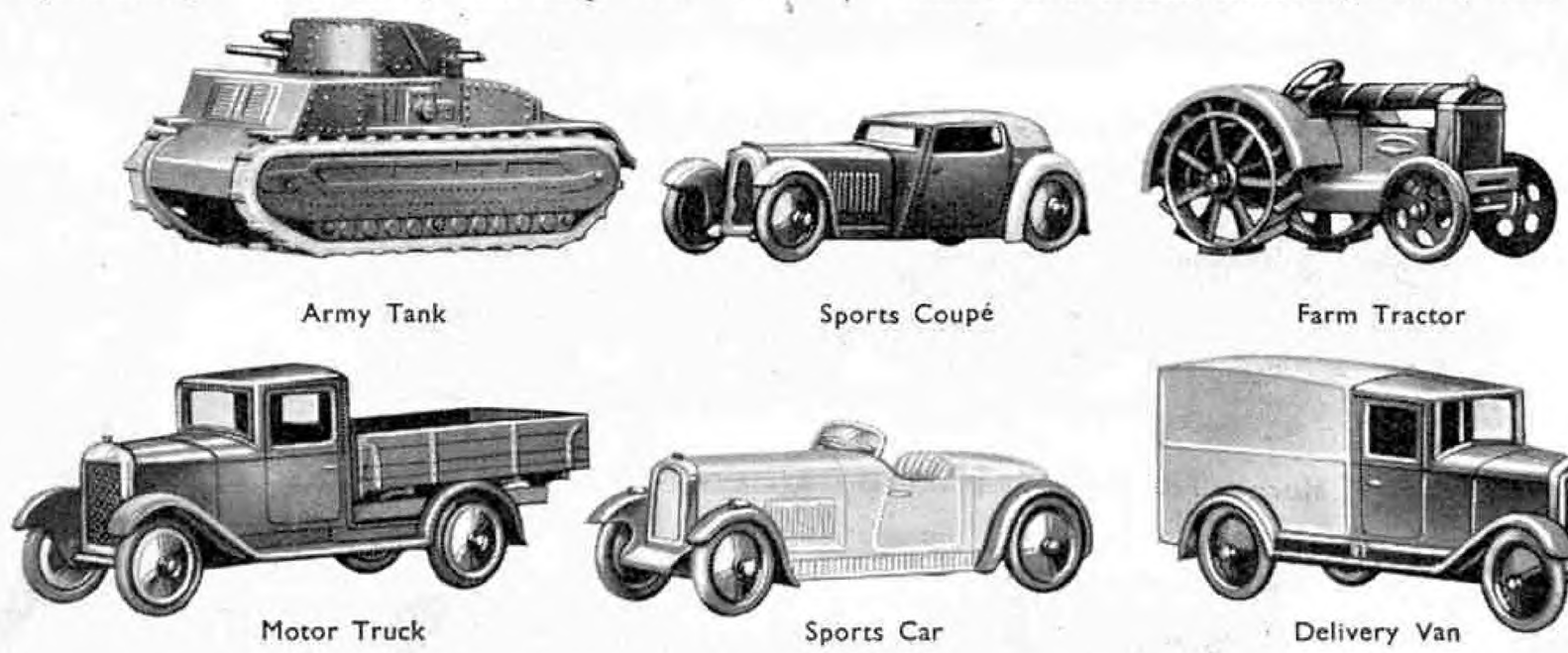
Trains, Motor Vehicles, and Farm Animals

THE earlier sets in the popular Modelled Miniatures Series—Railwaymen, Passengers, Hotel Staff, and Engineers—have all been described in detail in the *"M.M."* On this page we illustrate three further sets that are particularly attractive, and we are sure that readers who do not possess these sets will lose no time in bringing their good points to the notice of parents, uncles and aunts, and other relations who may be expected to rise to the occasion at Christmas!



The attractive Farmyard Animals, Modelled Miniatures No. 2, described in this article. Their natural appearance is particularly notable.

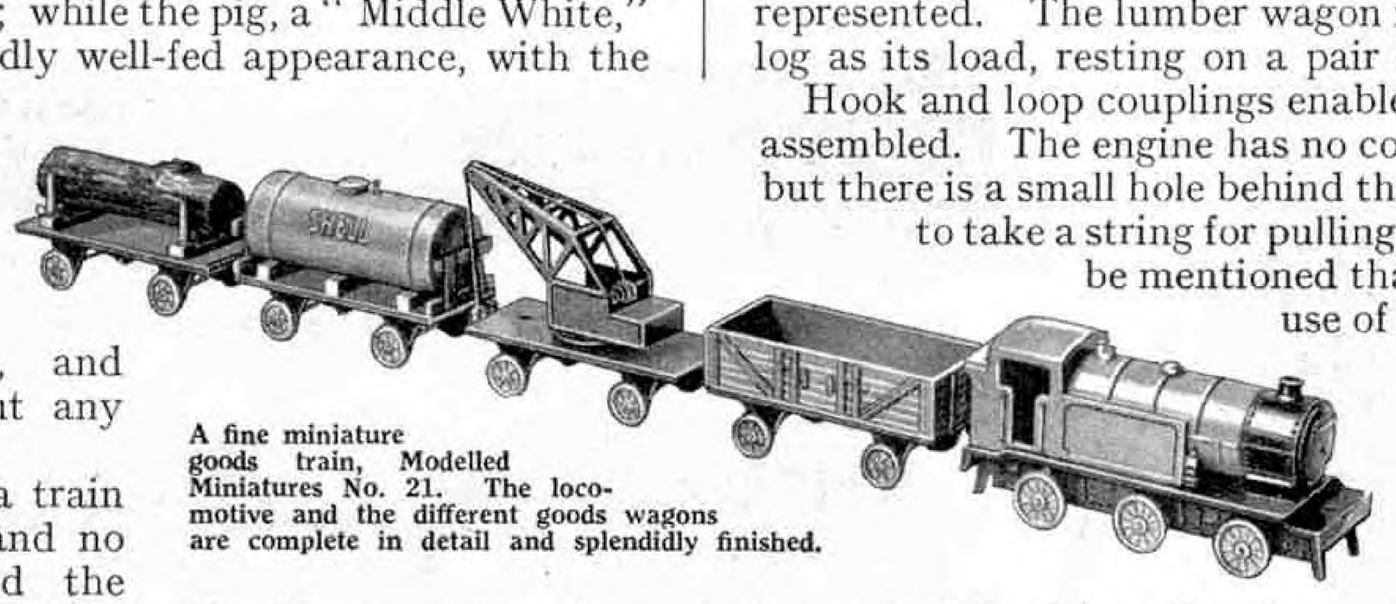
Taking the sets in their numerical order, we have first Modelled Miniatures No. 2, which consists of Farmyard Animals. There are two well-proportioned horses, one a grey and the other a "liver" chestnut with white markings. The cows, also two in number, are splendidly modelled, having all the distinctive features of build peculiar to their kind. They are bulky in the body and have quite the air of prize-winning cattle, one being a "Devon Red" and the other a "British Holstein." The other members of this set are a sheep and a pig. The sheep, which resembles a "Ryland" ewe, is finished in a realistic manner, and has quite a "woolly" look; while the pig, a "Middle White," is an animal of decidedly well-fed appearance, with the heavy snout and diminutive tail peculiar to his race. An important feature of all these animals is that they are nicely balanced, and stand up well without any wobbliness.



The motor vehicles of Modelled Miniatures No. 22. These are realistic and varied, as the photograph shows.

Those who require a train that needs no track and no winding up will find the Train Set, Modelled Miniatures No. 21, very attractive. The "push along" type of train has a great fascination, especially for younger railway enthusiasts, and its activities are not limited by the extent of a system of rails. This set consists of a locomotive and four wagons, as shown in the bottom illustration on this page. The locomotive runs on six wheels, and in its general design is typical of the average tank locomotive built for local goods and shunting work. It is of up-to-date character, having the large boiler typical of modern locomotives, and the details are particularly complete.

Each of the four wagons has a similar type of base or underframe consisting practically of a flat truck mounted on four wheels. The open truck is formed by the attachment of a miniature wagon body to this underframe. The body is made to represent the usual wooden goods truck, and is provided with neat strapping and other fittings. The crane truck is formed by the crane base, turntable and jib secured as one unit to the standard underframe. The crane has a miniature crank handle, hook, and length of thread that makes its operation possible; and if required the crane portion can be rotated on the base of the wagon.

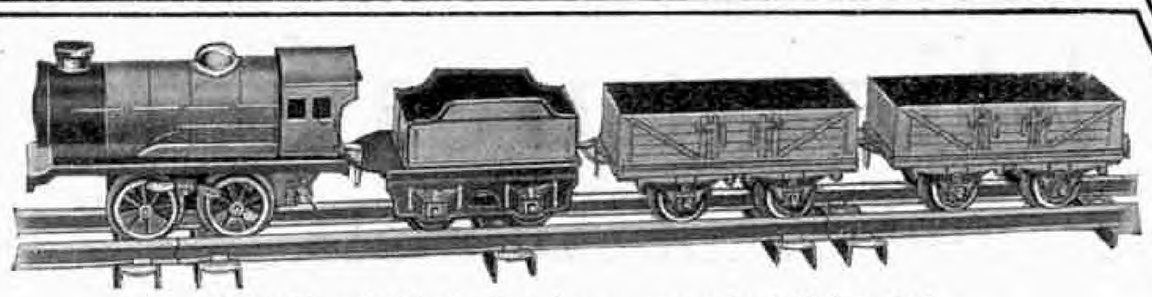


A fine miniature goods train, Modelled Miniatures No. 21. The locomotive and the different goods wagons are complete in detail and splendidly finished.

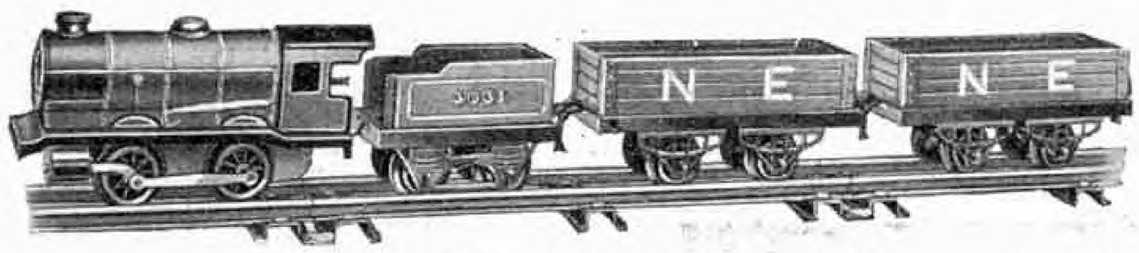
The "Shell" petrol wagon consists of a large-capacity tank with its various supports mounted on the standard base. The tank is complete with a manhole and valve on the top, and holding-down straps and rivets are also represented. The lumber wagon is arranged with a large log as its load, resting on a pair of realistic bolsters.

Hook and loop couplings enable a complete train to be assembled. The engine has no coupling at the front end, but there is a small hole behind the buffer beam, intended to take a string for pulling the train along. It may be mentioned that this hole can be made use of also if it is required to run the engine backward with its load. The hooks on the wagons will drop into the hole easily, and the train may thus be worked in either direction.

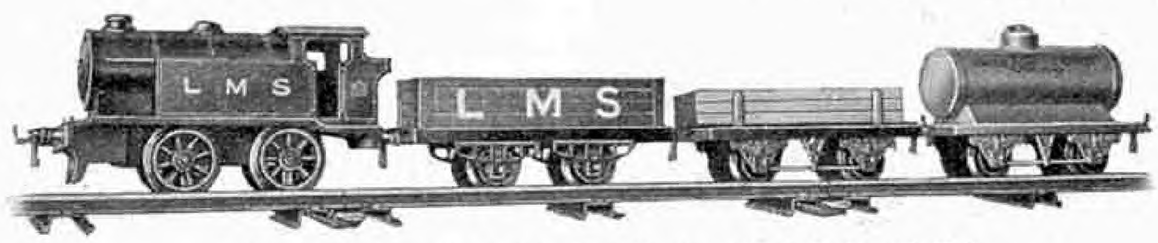
Of the motor vehicles, Modelled Miniatures No. 22, the Army tank is the most striking example, and it looks extremely effective. It is realistically moulded to give the correct impression of a riveted plate structure, and it is surmounted by a gun turret that can *(Continued on page 996)*



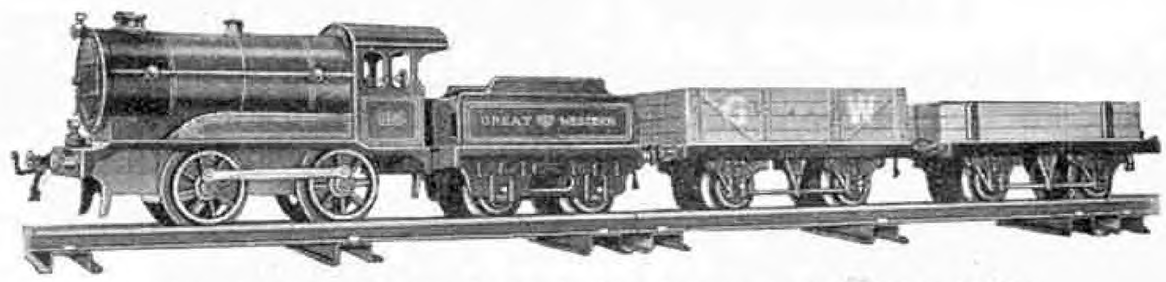
MO Goods Train Set (non-reversing) Price **5/-**



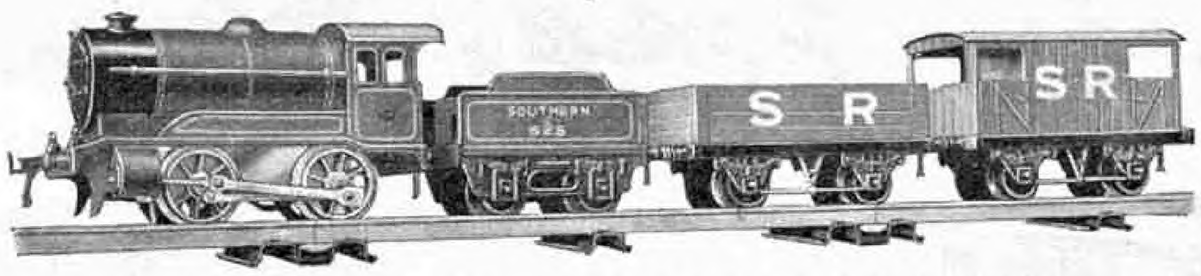
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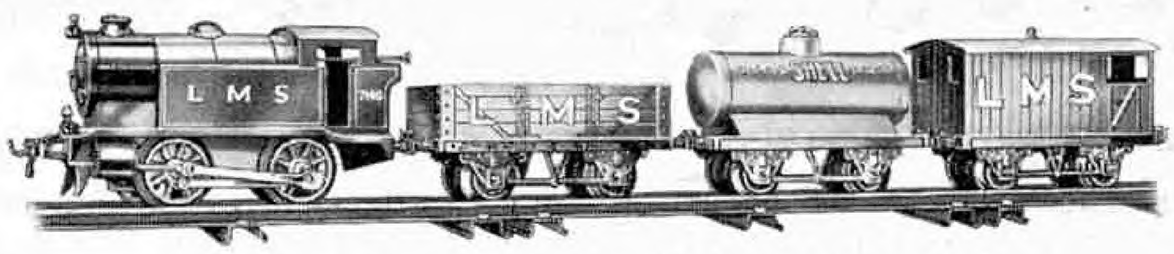
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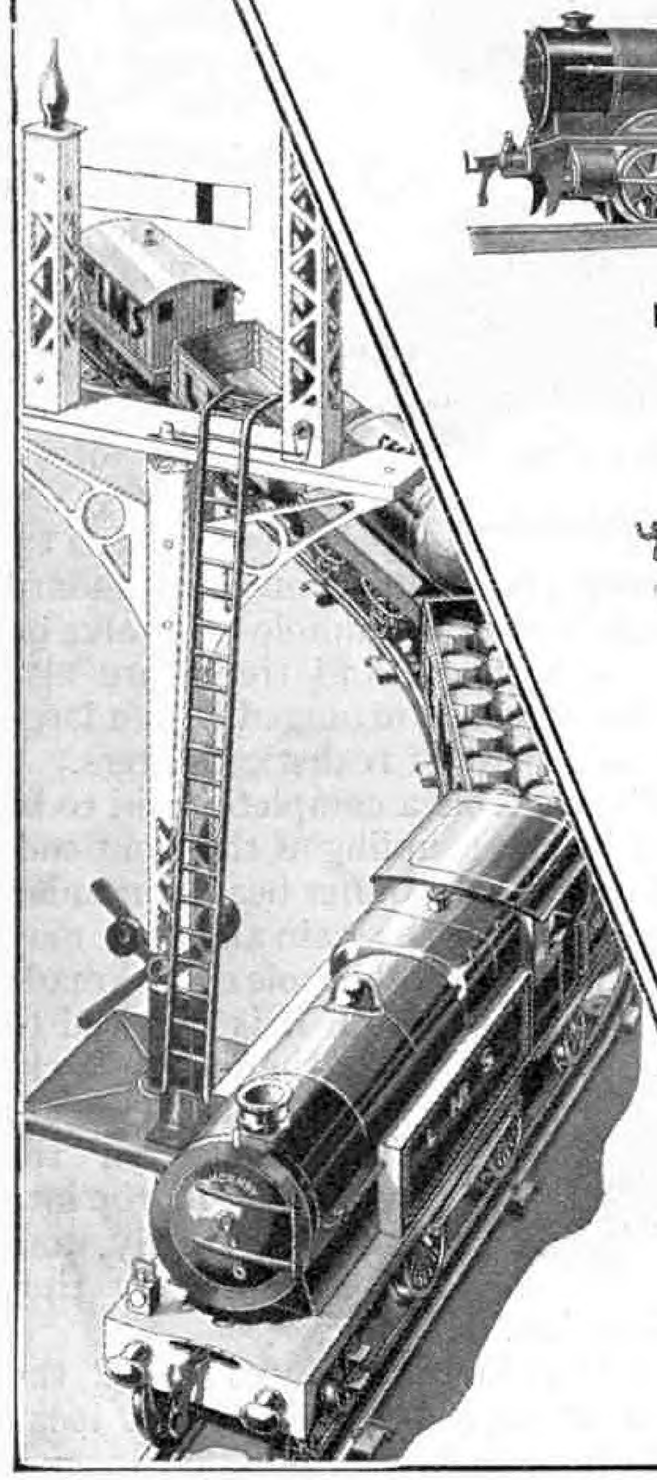
Hornby No. O Goods Train Set (reversing) Price **18/6**

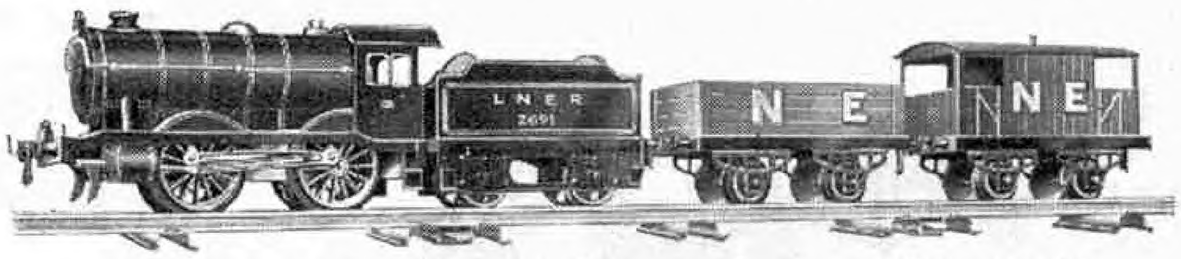


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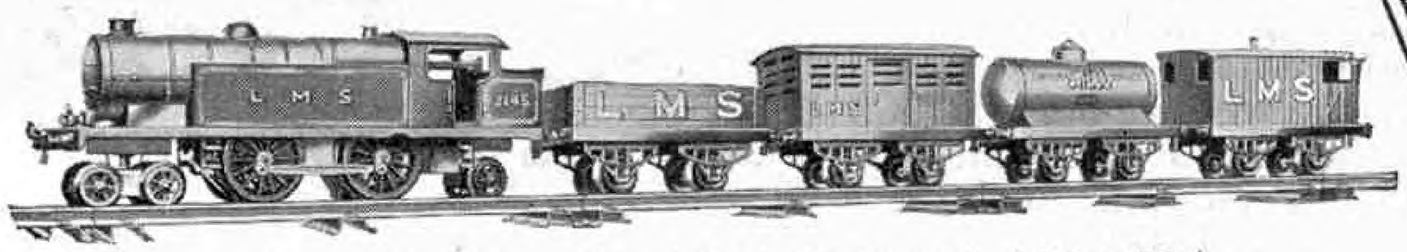


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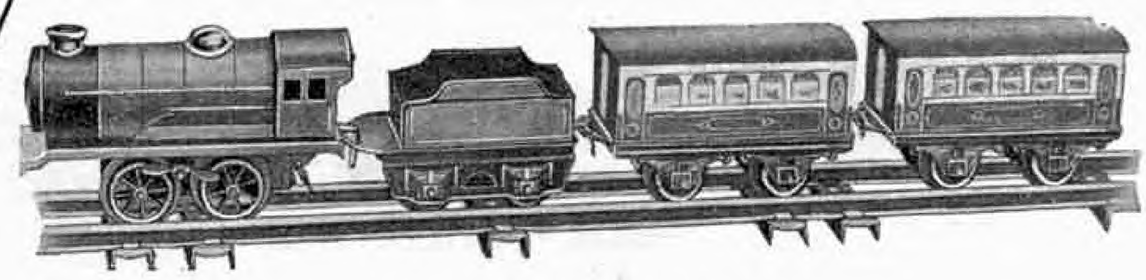
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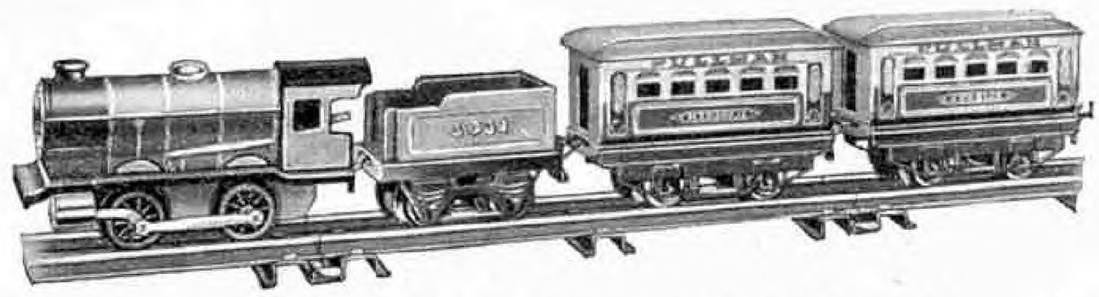
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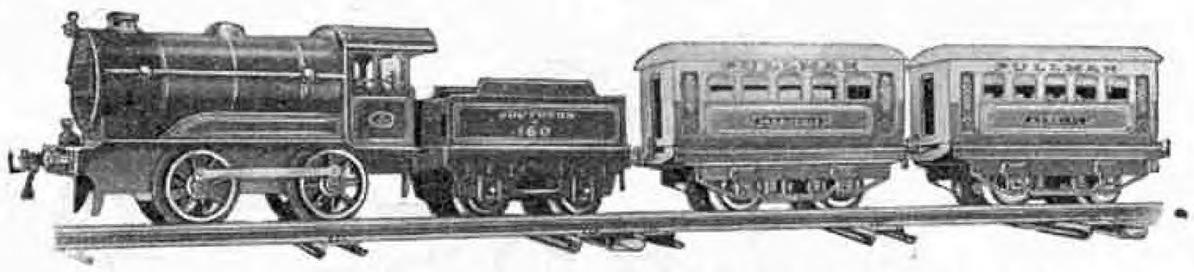
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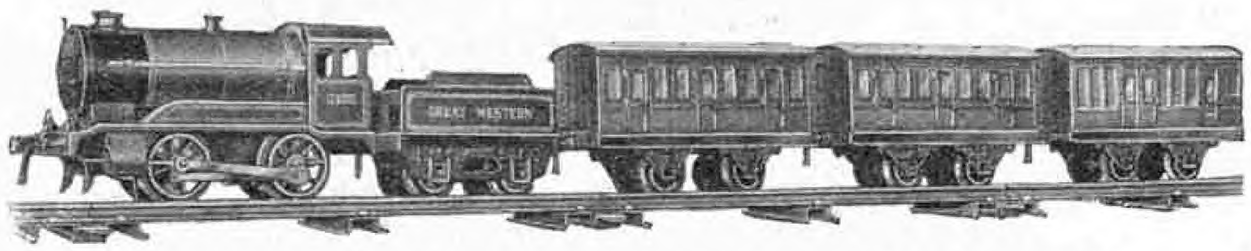
MO Passenger Train Set Price **5/9**



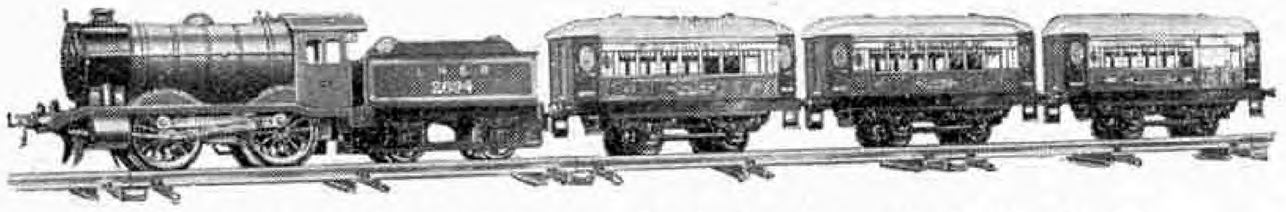
M1 Passenger Train Set (non-reversing) Price **9/3**



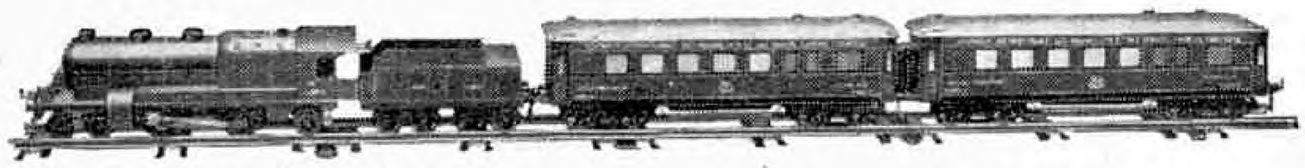
Hornby No. O Passenger Train Set (reversing) Price **17/6**



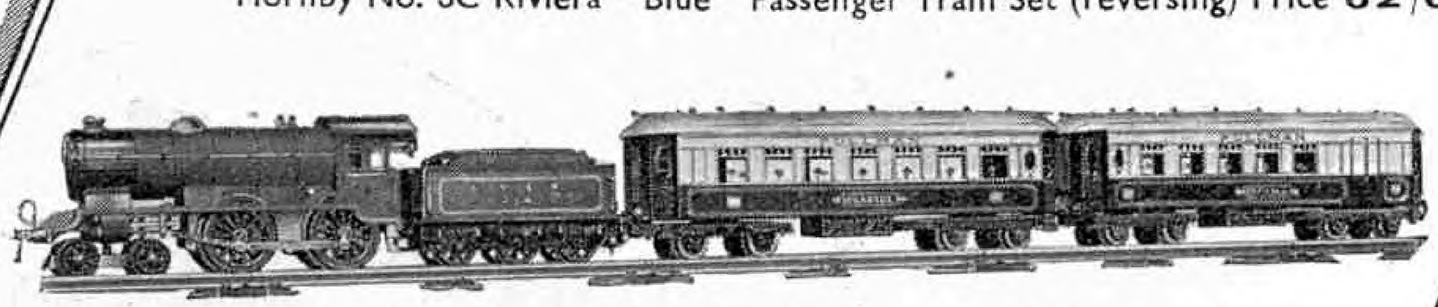
Hornby No. 1 Passenger Train Set (reversing) Price **28/6**



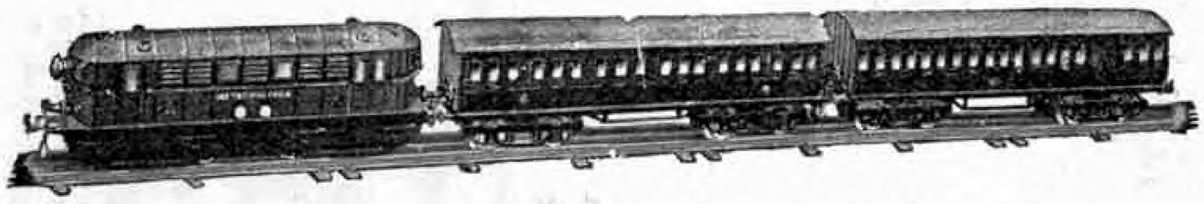
Hornby No. 1 Special Passenger Train Set (reversing) Price **35/-**



Hornby No. 3C Riviera "Blue" Passenger Train Set (reversing) Price **62/6**

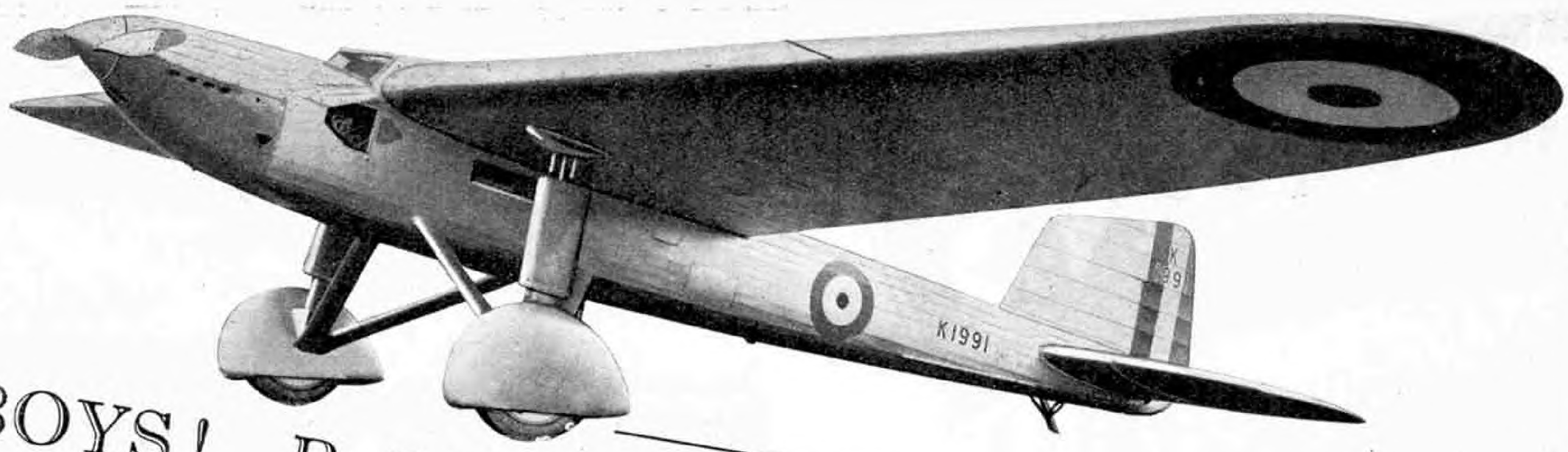


Hornby No. 2 Special Pullman Train Set (reversing) Price **67/6**



Hornby Metropolitan Train Set C (reversing) Price **45/-**

· BINNS ROAD · LIVERPOOL · 13 ·



BOYS! Build Realistic Models of the World's finest aircraft with

MECCANO AEROPLANE CONSTRUCTOR OUTFITS

When you own a Meccano Aeroplane Outfit you are able to build magnificent models of the latest types of aeroplanes—the most realistic models you ever saw! The parts contained in these Outfits enable aeroplane construction to be carried out on sound engineering lines because they are all interchangeable on the famous Meccano principle. Buy a Meccano Aeroplane Outfit to-day!

PRICE LIST

SPECIAL SERIES

No. 1 SPECIAL AEROPLANE OUTFIT. The parts in this Super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. Price **15/-**

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All Meccano Aeroplane Outfits are available in three different colour combinations—Red and Cream, Blue and White and Green and Ivory.

STANDARD SERIES

No. 0 AEROPLANE OUTFIT. An interesting range of models can be built with this Outfit, including high and low wing monoplanes. Price **5/-**

No. 01P AEROPLANE HANGAR OUTFIT. This novel Outfit consists of the complete range of No. 0 Aeroplane Outfit parts packed in a No. 01 Aeroplane Hangar. Price **10/-**

Note. The parts in the No. 0 and No. 01P Aeroplane Outfits are not intended for use with any of the other Outfits.

No. 1 AEROPLANE OUTFIT. Magnificent models of high and low wing monoplanes, and interesting model biplanes can be built with this fine Outfit. Price **9/-**

No. 2 AEROPLANE OUTFIT. This Outfit enables a splendid range of models to be built, including triple-engined monoplanes and biplanes, and a racing seaplane. Price **16/6**

MECCANO LIMITED
Binns Road, Liverpool 13





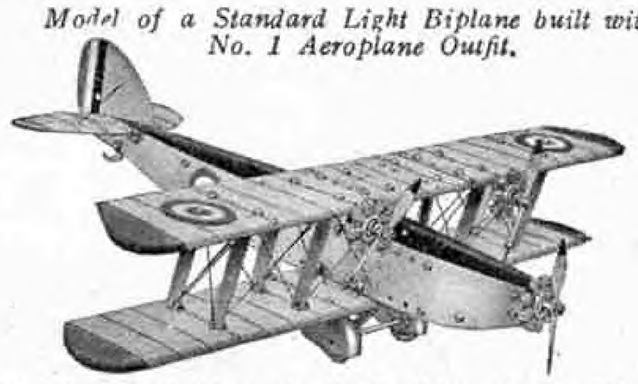
Model of a Racing Seaplane built with No. 2 Aeroplane Outfit.



Model of a high wing Monoplane built with No. 1 Aeroplane Outfit.



Model of a Standard Light Biplane built with No. 1 Aeroplane Outfit.



Model of a Triple-engined Air Liner built with No. 2 Aeroplane Outfit.



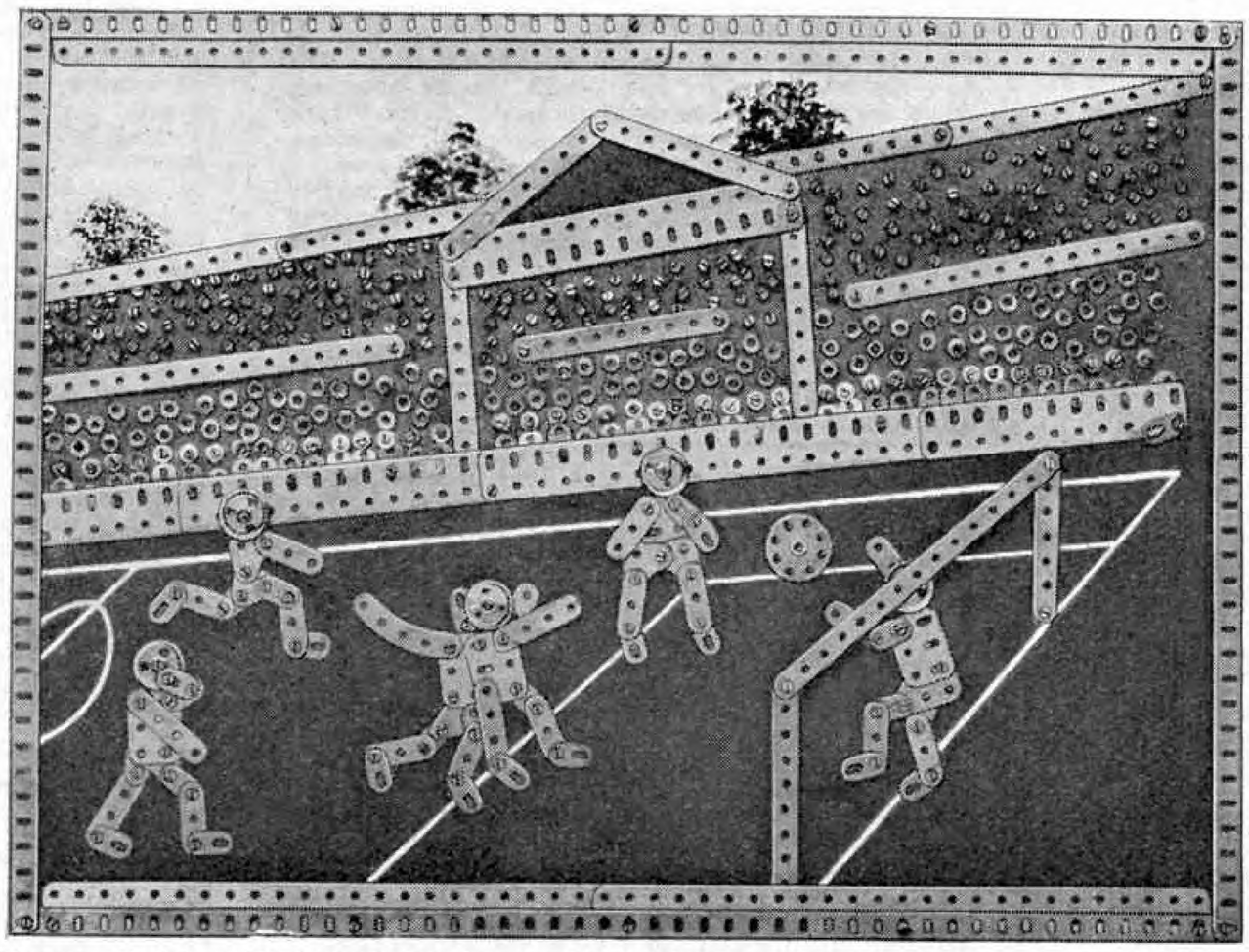
Aeroplane Constructor Outfit No. 1.

Prizes for Model-Builders

Novel "Meccano Picture" Competition

The Contest announced this month offers a welcome change from ordinary model-building competitions, and is the first of its kind that we have organised. On this page appears an illustration of an exciting incident in a football match! As a glance will show, this picture, with the exception of the trees, is made up entirely from simple Meccano parts bolted to a piece of cardboard that serves as a background. Although the picture contains only a few parts, a very realistic effect has been obtained, and it appears to us that there is considerable scope for making other pictures in this way. We are therefore offering a number of fine prizes for the most interesting and novel Meccano pictures submitted to us by readers of the *"M.M."*

We hope that every model-builder will enter this Contest, for it is great fun making pictures in this way, and there is always the chance of winning a valuable prize. Readers may make any kind of picture they like best. A suitable subject would be a sailing ship at sea, with a lighthouse and a few rocks to complete the effect; or a picture of a street showing shops, and perhaps the outside of a big building such as a theatre or a church, would be fascinating to construct. A few minutes' thought will provide dozens of other ideas for making really good pictures, and there should be no difficulty in finding a subject suitable to the quantity of Meccano parts available.



Meccano "pictures," of which this is a good example, form the subject of the novel competition announced on this page.

Competitors who wish to increase the realism of their "pictures" may do so by painting the cardboard background in suitable colours. In the case of the picture illustrated on this page, the football field was painted green and the sky white, and the tops of trees were painted in over the grand stand.

There will be two Sections only—A, for competitors living in the British Isles, and B, for those living overseas. The following prizes will be awarded in each Section. First: Meccano or Hornby goods value £3-3s. Second: Goods value £2-2s. Third: Goods value £1-1s. Five Prizes of goods value 10/6. Five Prizes of goods value 5/–.

After the picture is complete the competitor should obtain a good photograph of it. This may be taken by the competitor himself or by a professional photographer, and should be as sharp as possible.

The competitor's age, name and full address must be written clearly on the back of each photograph sent in, and entries should be addressed to "Meccano Picture Competition," Meccano Ltd., Binns Road, Liverpool 13. The closing dates for the Contest are:—Section A, 31st January, 1934; Section B, 31st March, 1934.

Photographs or drawings of prizewinning models become the property of Meccano Ltd. Unsuccessful entries will be returned provided that a stamped envelope is enclosed with the entry.

"Christmas" General Model-Building Competition

This Contest is open to Meccano models of any kind of engineering subject, and there are no restrictions as to the size of Outfit or number of parts that may be used. Competitors are thus allowed unlimited scope to give their model-building abilities full rein.

It is a very easy matter to enter the competition, because there are no entrance fees and no tiresome entry forms to be filled in. The hardest task perhaps is to choose a suitable object for modelling, but here again little trouble need be experienced, for the range of engineering subjects that can be copied is enormous. New developments in ships, aircraft, motor vehicles and machine tools are taking place continually, so that it is always possible to find a subject that is original in some respect.

It is important to note that all models entered in the Contest must be the competitors' own unaided work. A well-built model of a simple object will have a better chance of carrying off the principal prize than a complicated but crudely built model.

In order to treat each competitor as fairly as possible, the contest is divided into three Sections as follows:—Section A, for competitors over 14 living in the British Isles; Section B, for those under 14 living in the British Isles; Section C, for competitors of all ages living overseas. Although the entries of overseas competitors will be grouped into one Section, the age of each individual competitor will be taken into consideration in judging the models.

The prizes to be awarded in each Section are: First Prize, Meccano or Hornby goods value £3-3s. Second Prize, Goods value £2-2s. Third Prize, Goods value £1-1s. Five Prizes of Goods value 10/–. Five Prizes of Goods value 5/–. Twelve Prizes of Meccano *"Standard Mechanisms"* Manuals. Certificates of Merit also will be awarded in each Section.

It should be noted that the prizes will be awarded principally for originality of subject and correct mechanical construction. The judges will also pay particular attention to models that are neatly built and do not incorporate a lot of unnecessary parts.

When the model is completed the competitor should obtain a photograph of it, or if this is not possible, prepare a good drawing. It is not necessary for these to be the competitor's own work. If the photographs or drawings do not show the main mechanical or constructional features of the model quite clearly, it will be advisable to prepare also a short description of the model. The competitor should write his age, name and full address, on the back of each photograph or drawing and should post them to "Christmas Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13.

Photographs and drawings of unsuccessful entries will only be returned to the senders when a stamped addressed envelope is enclosed with the entry. It should be noted, however, that photographs or drawings of prizewinning models become the property of Meccano Ltd. The actual model must not be sent.

Entries for Sections A and B may be sent any time before 31st January, 1934. Entries for Section C must be posted so as to reach Liverpool before 31st March, 1934. Any entries received after these dates will be disqualified.

Solutions to Puzzles

(*See page 983*).

No. 1. The message on the sandwich boards is:

S A L E O F F U R S
N O W G O I N G O N

No. 2. The proverb is: "A stitch in time saves nine."

No. 3. A match.

No. 4. The Meccano parts are: Trunnion, Bolt, Strip, Architrave, Worm, Screwdriver, Spring, Crank, Spanner, Coupling, Hinge, Shuttle, Fan, Pointer, Boiler, Hook.

No. 5. The long division sum is:—

```
13)8290(637
   78
   —
   .49
   39
   —
   100
    91
    —
    ..9
    —
```

No. 6. The words are:
D,
DO,
ODE,
LODE,
LODGE,
GOLDEN,
DONEGAL.

No. 7. The lipogram is the first verse in D. G. Rossetti's well-known poem, "The Woodspurge." It is:—

"The wind flapped loose, the wind was still,
Shaken out dead from the tree and hill:
I had walked on at the wind's will,—
I sat now, for the wind was still."

No. 8. The horseshoe is first cut straight across between the second and third nails in each "leg." The two legs are then placed on each other, and the upper portion containing three nails is placed on top of these, so that with one cut of the scissors each of the legs is separated into two halves, while the top portion is separated into three pieces.

No. 9. The words are:—

DISABLE
HATED
MAD
L
HAS
INNER
CUSTARD
ATALANTAS

The hidden name is Atalanta.

No. 10. The jumbled words make up the following names:—1. Kingsford-Smith; 2. Shackleton; 3. Scott; 4. Sutcliffe; 5. Nawab of Pataudi; 6. Bastin; 7. Cresswell; 8. Borotra; 9. Austin; 10. Mollison.

No. 11. The parts are: 1. Train Coupling; 2. Dog Clutch; 3. Rubber Ring.

Curved Rails (Electric)

Owing to a printer's error, the price of Electrical Curved Rails (EA2) is shown in the 1933 Hornby Train Folder as 6/– per doz. instead of 6/6. Will all who have obtained copies of the folder from their dealers please note.

A South African Model-Building Contest

A Meccano Model-building Competition organised last September by G. Oats and Co., Kimberley, South Africa, attracted a large entry of models that were remarkable for their originality and high standard of construction. First prize in Section A, for competitors from 16 years to 21 years of age, was won by J. O'Connor Foley, with a steam-electric excavator that earned for its builder the special compliments of the judges. H. Mantle carried off the chief prize in Section B, for entrants from 12 to 15 years of age, with a diamond digger's gear and crane. Mantle's model was of outstanding merit and he fully deserved the special prize awarded him for it. First prize in Section C, for those under 12 years of age, was awarded to N. D. Love, who exhibited a transporter bridge.

Other models included in the long prize lists in the three sections of the competition were little behind in merit those earning the chief awards, and the entries aroused universal interest and admiration when displayed in the window of Messrs. G. Oats and Co.

A Splendid Tool Set

At heart every boy is a handyman, and he will be a lucky boy who secures one of the splendid "Kelson" Cabinets of Tools as a Christmas gift. Everything that the amateur carpenter could desire is included.

Robert Kelly & Sons Ltd., Renshaw Street, Liverpool, who are also Meccano dealers, will be glad to send an illustrated folder to any "*M.M.*" reader who applies for details of this splendid tool kit.

Modelled Miniatures—(*Continued from page 991*)

be made to swivel round in the appropriate manner. The continuous "caterpillar" track of the original is reproduced by specially moulded rubber bands running over concealed pulleys. When the tank is pushed along these caterpillar bands function very well, and it can be made to surmount obstacles in the manner of its prototype. Its uses in connection with miniature soldiers are obvious, while it makes a very interesting load for Hornby goods wagons.

Another attractive model is the farm tractor. This follows the usual lines of such familiar vehicles as the "Fordson," and is a most realistic piece of work. The engine unit and undercarriage are correctly copied, and the radiator, petrol tank and steering wheel are all included. Even the uncomfortable-looking type of seat that is characteristic of agricultural vehicles is provided. The front wheels are of the disc pattern, while the driving wheels are spoked and provided with the special treads actually used to enable the tractor to travel on grass or earth without difficulty in the course of its work.

The delivery van and the motor truck are typical of the lighter types of commercial vehicles in common use to-day, and an interesting point about them is that the same chassis and cab is used for each. The van has a typically "coach-built" body attached, while the truck has the usual planked "wagon" type body. Plated radiators are provided, and the wings, footboards and other details are well reproduced.

The two passenger cars are both of the sports variety so popular nowadays. The low-built coupé is essentially up to date, and has independent wings to each wheel, a rounded radiator, and sloping back. The open sports car is of heavier and more powerful build. The low windscreen typical of such cars is fitted, also a dashboard, steering wheel and well-upholstered seat.

Chemistry Aids Industry—(*Cont. from page 977*)

as rubber plating. An article that is to be coated with rubber is made the positive pole in a cell containing latex, and a uniform coating of this material is formed over it as the current passes through the liquid. Sulphur and other ingredients may be added to the latex used, and these are deposited with the rubber, which is then vulcanised by raising its temperature.

The coatings that can be obtained in this manner are seamless and range from soft rubber to ebonite. Some of them are so hard that they are applied for the protection of the metal screens used in sieving stones and minerals, and others are employed to safeguard metallic vessels liable to corrosion.

Another interesting application of latex is in the treatment of cords and ropes. These can readily be impregnated and coated with rubber in this form, and they last much longer than untreated cords. Transmission belts similarly covered are insensitive to moisture and therefore give more efficient service.

A Melbourne Air Photograph

Australian readers will be interested to know that the striking photograph of a parachutist falling head downward after jumping from an aeroplane, reproduced on page 578 of the "*M.M.*" for August last, was taken at Melbourne by a staff photographer of "*The Argus*," and first appeared in that paper.

The Speed Book of the Year

"Achievements of 1933" is a book that will appeal to boys of all ages for it tells in graphic word and picture the story of the big speed events of the year. It describes the longest, fastest and highest flights and the world's fastest speed attempt on land.

Malcolm Campbell, George Eyston, Kaye Don and Freddie Dixon are a few of the famous people whose adventures are described. The book is illustrated with numerous pictures, many of them reproduced for the first time. It deals not only with the very fine efforts of Britain's aces of the land and air, but also describes, with striking illustrations, many notable foreign achievements.

By special arrangement, readers of the "*M.M.*" can obtain a copy of "Achievements of 1933," free of charge, by applying to Messrs. C. C. Wakefield and Company, Wakefield House, Cheapside, E.C.2. They should mention the "Meccano Magazine" in their application.

Night Riding in Safety

In addition to the "Litalite" and "Dualite" Rear Lamps and Reflectors advertised elsewhere in this issue of the "*M.M.*", Messrs. Bluemel Brothers Ltd., are showing at the Olympia Cycle Show, now open, a new Super Safetiflap, an inexpensive white celluloid tail flap that has already achieved an outstanding popularity with cyclists who are compelled to indulge in much night riding. The heavy material used in its construction makes it very suitable for long distance and club riding.

Full details of this interesting range of safe cycling equipment will be given to any "*M.M.*" reader on application to Bluemel Brothers. Ltd, Wolston, Nr. Coventry.

Chemical Conjuring—(*Continued from page 979*)

The "Magic Brush" employed in this trick gives a more impressive display of its powers when it is made to print in different colours on the same piece of paper or sheet of card. This is easily arranged by using Tannic Acid solution for some of the letters or words to be revealed, as already explained, Sodium Thiocyanate solution for others, and a solution of Sodium Ferrocyanide of similar strength for the remainder. The effect of brushing with Iron Alum solution is to make these visible in black, red and bright blue respectively.

Tricks in which sympathetic inks are used are always attractive, and can readily be worked into an entertainment of this kind. One of the most effective of these inks is made by dissolving a measure of Cobalt Chloride in half a test tube full of water. Messages written with this solution are practically invisible when dry, especially if paper with a light pink tone is used; but reveal themselves in blue letters on warming by holding in front of a fire or an electric radiator. The writing fades away again, but can be made alternately visible and invisible by warming and allowing to cool.

For our present purpose, secret messages poking good-humoured fun at members of the audience can be written with Cobalt Chloride solution on slips of paper. Exhibiting one of these slips to show that nothing is visible on it, the spirits are asked for a message while the paper is waved over a spirit lamp, or warmed in the manner already suggested.

A very pretty trick that always arouses interest is illustrated in Fig. 3. The cheery Meccano boy shown can be made to blush at will, but quickly regains his normal composure when left to himself. The drawing has been specially prepared for the purpose, but if there is any difficulty in obtaining one, the trick need not be abandoned, for it can be carried out equally well with a newspaper illustration in which the face is large and not too heavily shaded.

The only requirements in addition to the drawing are Phenolphthalein Solution, a bottle of household ammonia, and a small paint brush. The portions of the face that are to display the blush are painted with Phenolphthalein Solution. This is colourless, but immediately becomes pink when a small sponge that has been dipped in ammonia is held near it.

In our illustration the conjurer is causing the boy to blush by touching the back of the paper with the thumb of his right hand, which he has previously dipped in ammonia.

Two New Books by Your Editor

The Book of Air and Water Wonders

With Colour Frontispiece, 32 Half-tone Illustrations and some Line Drawings.

Mr. Ellison Hawks, in his usual fascinating way, describes the composition, extent, pressure, and temperature of the atmosphere; dew, mist, and fog; seasons, climate and winds; storms of various types; glaciers and icebergs; waterfalls and lakes, etc.

The Book of the Warship

With Colour Frontispiece, 32 Half-tone Illustrations, and some Line Drawings.

Commencing with the galleys of Egypt, Phœnicia, Greece and Rome, the gradual evolution of the warship is traced down to our own day. Special attention is paid to naval developments during the Great War.

Obtainable from all Booksellers
(Each 7/6 net)

HARRAP

Model-Building Contest Results

By Frank Hornby

Second "Realism" Competition

Examination of the entries in the Second "Realism" Competition shows that Meccano boys are quite as capable of designing artistic and realistic settings for their models as they are in building the models themselves. Many of the entries in this Contest are exceptionally good, and I very much regret that owing to the poor quality of the photographs submitted it is not possible to illustrate more of them. I have chosen two of the clearer photographs, however, to illustrate this article, and these will give readers some idea of the type of work that won the prizes. The prizes have already been despatched to the fortunate competitors named in the following list.

Section A (Home competitors over 14)

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: R. Sculpher, Tilbury, Essex. SECOND PRIZE, Goods value £2-2s.: E. Revell, Huddersfield. THIRD PRIZE, Goods value £1-1s.: F. E. Nunn, Colchester.

SIX PRIZES of Meccano or Hornby goods value 10/6: H. Stephenson, Huyton, Liverpool; R. Hilling, Ipswich; S. Reid, Aberdeen; P. Morgan, Newcastle-upon-Tyne; V. Palmer, Jersey, C.I.; A. Ford, Wokingham.

SIX PRIZES of Meccano or Hornby goods value 5/-: W. Rowland, London, S.E.13; B. Freeman, London, S.E.7; D. Holloway, Squirrels Heath, Essex; S. Parker, Birmingham; B. Jones, Bristol; A. Williams, Liverpool.

Section B (Home competitors under 14)

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: J. Rickett, Takeley, Essex. SECOND PRIZE, Goods value £1-1s.: P. Ward, Southampton. THIRD PRIZE, Goods value 10/6: G. Wright, Chester.

SIX PRIZES of Meccano or Hornby goods value 5/-: T. Comerford, Rathdrum; D. Nock, Shifnal; L. Hollings, Leeds; G. Balfour, Upminster; H. Cowen, London, N.W.4; J. French, Huddersfield.

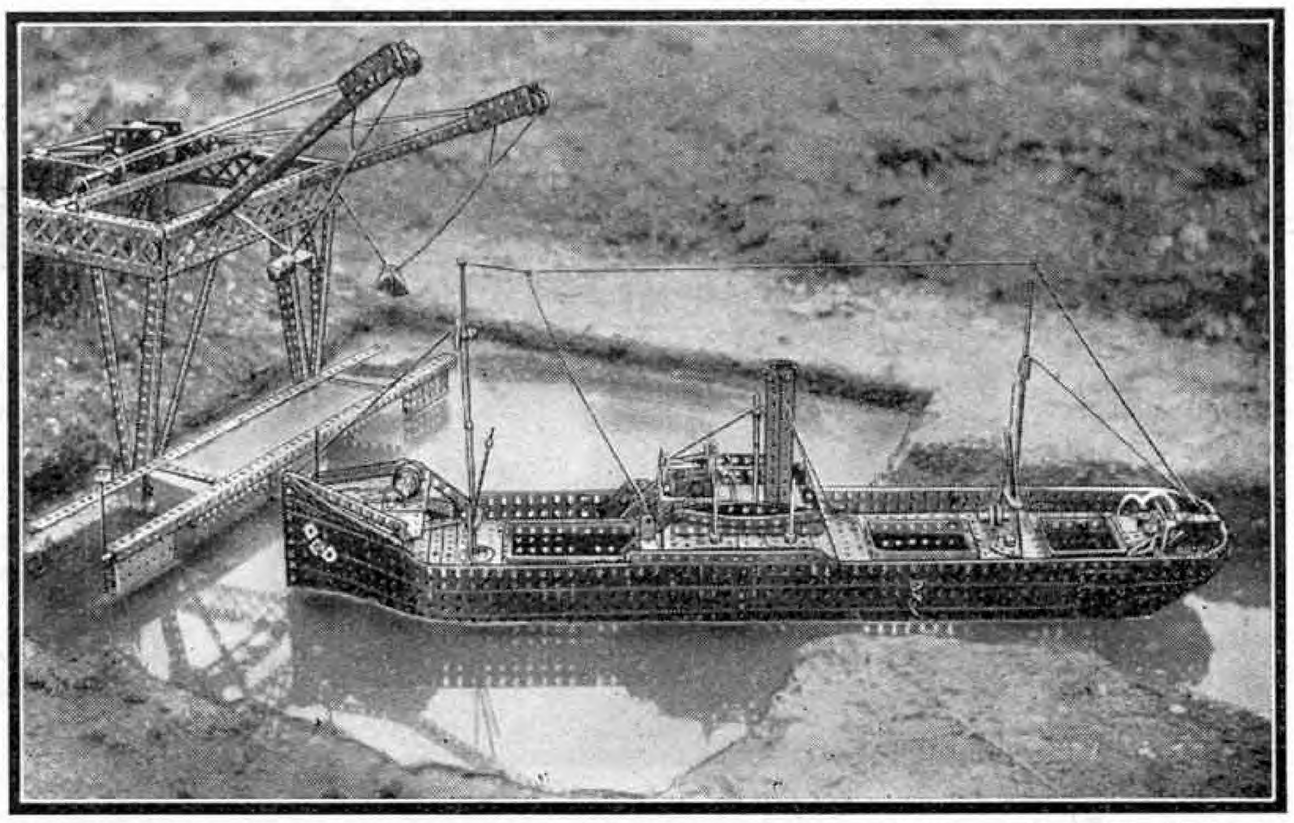
PRIZES of "Meccano Engineer's Pocket Books": G. Millington, Timperley; D. Clarkson, London, N.W.6; E. Lowe, Welwyn Garden City; R. Lunn, Doncaster; B. Richards, Manchester; J. Twyman, Orpington; L. Slater, Portsmouth; N. Beck, Howden-le-Wear; W. Pegum, Ballylongford, Co. Kerry; J. George, Bordon; E. Jacobsen, Iver, Bucks.

Section C (competitors Overseas)

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: J. Johnson, Te Kuiti, N.Z. SECOND PRIZE, goods value £2-2s.: D. Redman, Calgary, Canada. THIRD PRIZE, goods value £1-1s.: J. Willems, Antwerp, Belgium.

SIX PRIZES of Meccano or Hornby goods value 10/6: A. Johnstone, Piora, N.S.W.; L. Cooper, Cospicua, Malta; L. Osborne, Dandenong, Aust.; T. Paterson, Floriana, Malta; D. Parker, N. Battleford, Canada; B. Gledhill, Carenten, Manche, France.

SIX PRIZES of Meccano or Hornby goods value 5/-: P. Gledhill, Carentan, Manche, France; T. Doyle, Regent N.19, Victoria, Aust.; A. Boeke, Baarn, Holland; A. Mair, Invercargill, N.Z.; D. Burne, Durban, S.A.; D. Nelson, Masterton, N.Z.



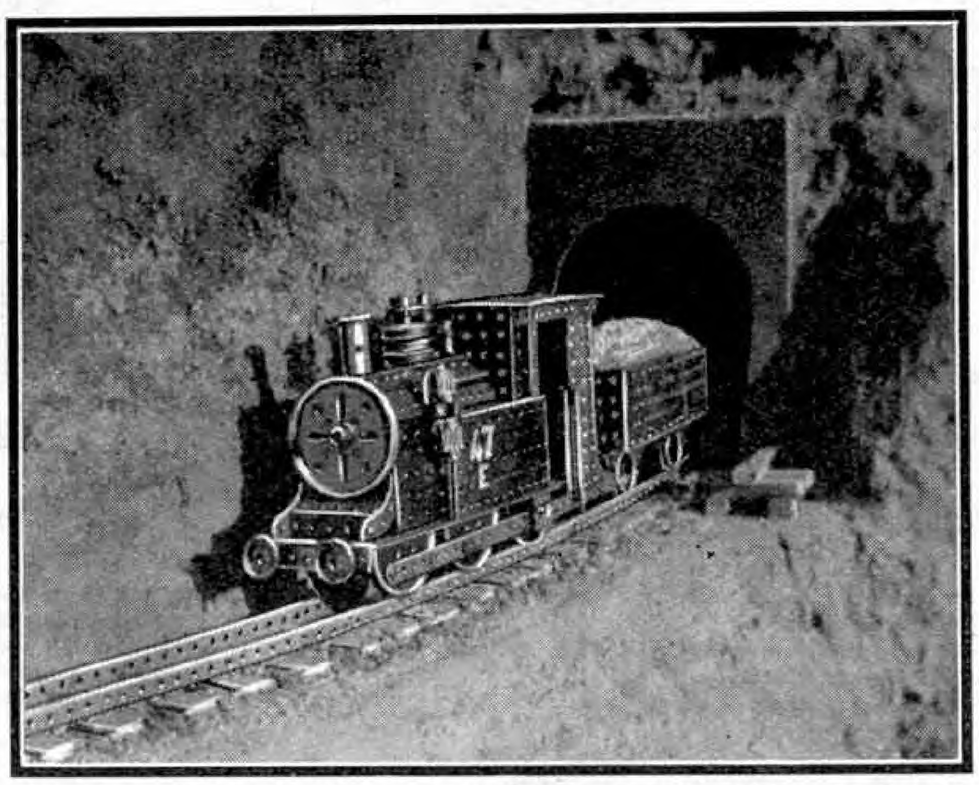
This realistic scene was designed and arranged by R. C. Sculpher, Tilbury, and won First Prize in Section A of the Second "Realism" Contest.

The realistic scene reproduced in the upper illustration on this page won First Prize in Section A. It depicts a collier manœuvring to tie up alongside a coaling wharf, on which are two cranes fitted with grab buckets for unloading the vessel. The ship itself is built with considerable care and skill, and chains are placed in the bows in readiness for mooring it to the quay side. The reflections in the water add greatly to the general realism, and the rugged background forms an excellent setting.

The lower illustration shows the First Prize model in the Overseas Section. In this case the setting is probably the best feature of the entry, for the construction of the model locomotive appears to be capable of improvement. The locomotive is hauling a railroad construction train, and is driven by a Clockwork Motor.

Second Prize in Section A was awarded for an entry that incorporates both an ordinary Meccano model and a model built from the No. 2 Meccano Motor Car Constructor Outfit. The scene shows a tourer type motor car speeding along a country road, hauling a trailer caravan of the kind now popular in England. The caravan is a splendid piece of work, and is made very realistic by the addition of miniature curtains made from crepe paper. It is mounted on two wheels placed centrally under the body, which is provided with legs that support it when at rest, and fold up underneath the body when not in use. The "road" is very life-like, and I understand that it is a garden path with miniature trees and fences suitably arranged as the background. This entry is the work of E. Revell, Huddersfield.

F. E. Nunn sent two entries, one of which shows a Meccano lawn mower at work on a lawn, which by the way is a real one. By carefully placing the camera so as to obtain the best angle of view, Nunn has managed to secure a very realistic photograph, which shows the model in good proportion to its surroundings. The other entry of this competitor is a model of one of the huge towers of the "Grid" electricity scheme, and is photographed in position in a field. Both of these entries show careful Meccano construction and a good knowledge of photography.



A railway construction train emerging from a tunnel. This scene formed the entry of J. F. Johnson, Te Kuiti, New Zealand, and was awarded First Prize in the Overseas Section of the "Realism" Competition.

First Prize in Section B was won by J. W. Rickett, who arranged a scene showing haymaking machines at work. The machines, which are all carefully built and contain a great amount of detail, comprise a tractor, a swarth turner and a hay sweep. All of them are working models.

Two other interesting entries in Section B are a country cross-roads scene, by G. Wright, and a "sea" scene by P. Ward. Wright's entry is made up of a heavy motor van, a sign post, some miniature railings, a wayside inn and a house or two. These simple components are arranged in a very clever manner to represent a typical English country road scene. P. Ward's entry is in less cheerful tone, for it shows a two-funnelled ship high and dry on the rocks, while two tug boats are endeavouring to refloat her, with a third tug standing by. The ships are placed in real water, and a splendid rock effect is obtained with a few big stones. This is quite a novel entry, and if a little more care had been taken in building the ships it would have had a good chance of winning the First Prize.

HORNBY MODELLED MINIATURES

ADD REALISM TO YOUR RAILWAY

Boys, think how your railways would be improved by the addition of the interesting items shown on this page ! You must have railwaymen to deal with your trains, and passengers to travel in them ; car attendants to look after the passengers, and engineers for the maintenance of the railway and its equipment. You want farmyard animals for lineside fields, and motor vehicles for road traffic. Then you should have at least one of the famous " Hall's Distemper " advertisements alongside your line ! For running on the table when you cannot put down your layout, the miniature train set is exactly what you want. The Modelled Miniatures may be purchased in complete sets as shown or, with the exception of Hall's Distemper Advertisement, they may be purchased separately.

Guard, Porters, Engineers, Station Master, Hotel Staff, etc.

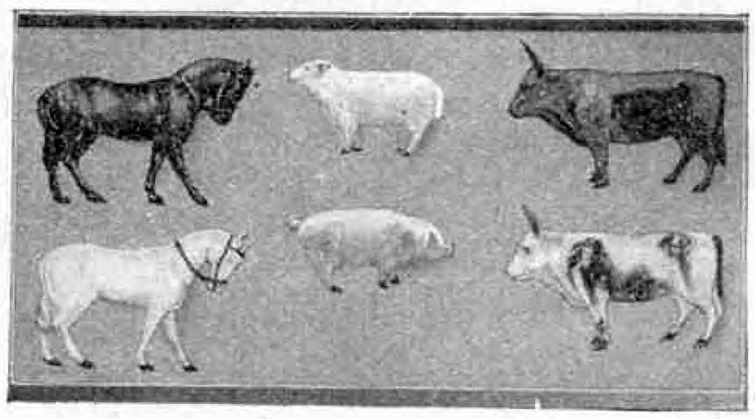
Hikers, Animals, Newsboy, Passengers, Motor Vehicles, etc.

PRODUCT of MECCANO LIMITED LIVERPOOL



Modelled Miniatures No. 1 Station Staff

These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. The complete set is composed of a Station Master to supervise operations, a Ticket Collector for the station barrier, a Guard giving the "right away" with his whistle and flag, a Locomotive Driver with his oil can, and two Porters, one with luggage and one without. Price, per set, **1/6**



Modelled Miniatures No. 2 Farmyard Animals

These miniature farmyard animals are useful for placing in lineside fields. The set comprises six animals : Sheep, Pig, two Cows, and two Horses.
Price, per set, **1/6**



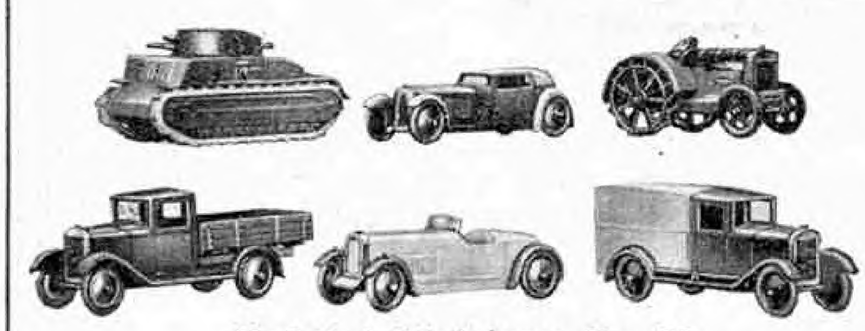
Modelled Miniatures No. 5 Train and Hotel Staff

Five figures are included in this set, including Pullman Car Conductor, two Pullman Car Waiters and two Hotel Porters. The Car Attendants are conspicuous in smart white jackets, and can be used on trains and in stations. The Hotel Porters, in livery, are essentially for use at important stations.
Price, per set, **1/3**



Modelled Miniatures No. 13 Hall's Distemper Advertisement

This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining the railway track. The two figures are die-cast while the plank they are carrying is of best quality pulp board, attractively printed in two colours.
Price **9**d.

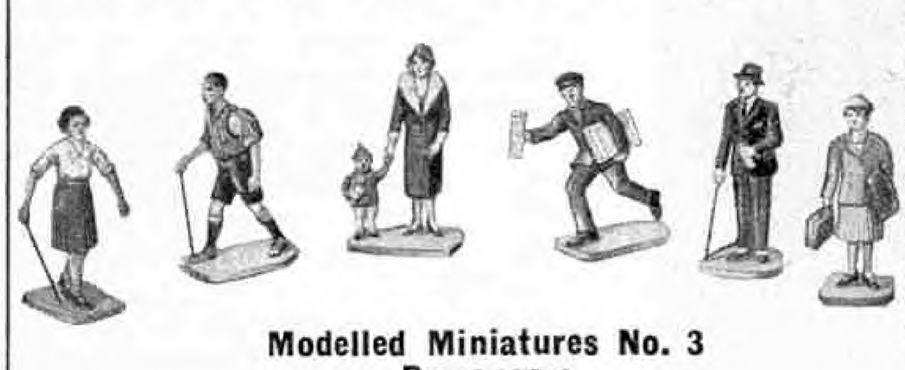


Modelled Miniatures No. 22 Motor Vehicles

This very attractive set of model miniatures consists of two Motor Cars, two commercial Vehicles, one Tractor and one Army Tank. The realistic design of each model is clearly shown in the above illustration. Price, per set, **4/–**

SEPARATE PRICES OF MODELLED MINIATURES

Modelled Miniatures Nos. 1, 3, 4 & 5		
Figures	each	**3**d.
Modelled Miniatures No. 2		
Cow	pair	**7**d.
Horse	,,	**7**d.
Pig	each	**2**d.
Sheep	,,	**2**d.
Modelled Miniatures No. 21		
Loco	each	**9**d.
Wagon	,,	**4**d.
Crane Truck ...	,,	**6**d.
Petrol Tank Wagon	,,	**6**d.
Lumber Wagon	,,	**5**d.
Modelled Miniatures No. 22		
Motor Cars ...	each	**6**d.
Commercial Vehicles	,,	**8**d.
Tractor	,,	**9**d.
Tank	,,	**1/–**



Modelled Miniatures No. 3 Passengers

The various types of passengers to be seen at any railway station are well represented in Modelled Miniatures No. 3. The set contains six figures as illustrated above, comprising Business Man, Male Hiker, Female Hiker, Newsboy, Lady and Mother with Child. They should appear on the station platforms, and they may also be used on lineside roads and fields.
Price, per set, **1/6**

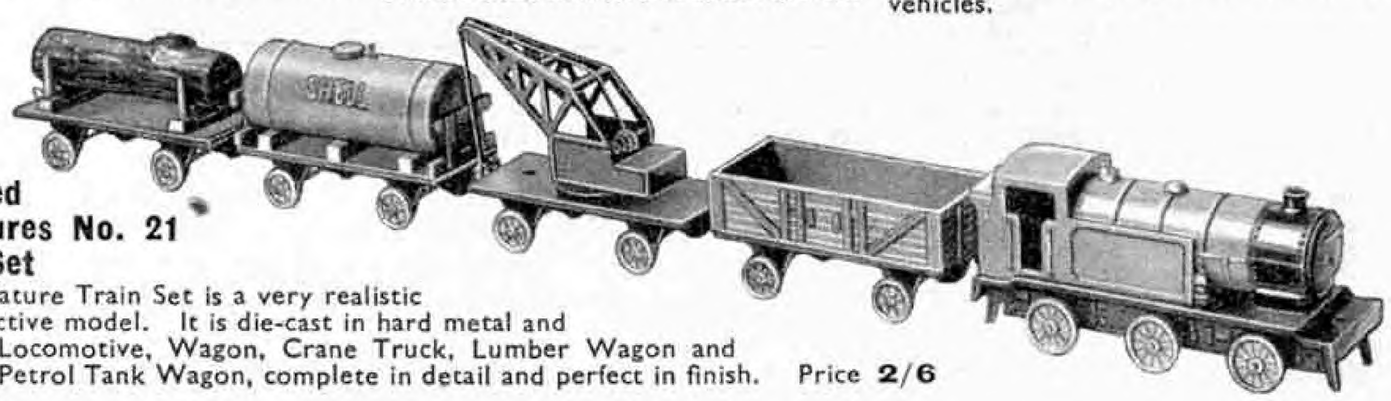
Ask your Dealer to show you these Modelled Miniatures



Modelled Miniatures No. 4 Engineering Staff

This set is composed of six figures representing Electrician, two Fitters, Storekeeper, Greaser and Engine Room Attendant. They may be used along the line and on railway premises generally, especially stations, engine sheds and yards. They may also be employed to attend to the miniature motor vehicles.
Price, per set, **1/6**

British and Fully Guaranteed



Modelled Miniatures No. 21 Train Set

This Miniature Train Set is a very realistic and attractive model. It is die-cast in hard metal and includes Locomotive, Wagon, Crane Truck, Lumber Wagon and "Shell" Petrol Tank Wagon, complete in detail and perfect in finish. Price **2/6**

Beautifully Finished in bright colours

Manufactured by Meccano Ltd., Binns Road, Liverpool 13

Making a Meccano Zoo

Novel Subjects for Model-Building

IT is a pleasant change to turn sometimes from serious model-building and try what can be done in Meccano with lighter subjects. The possibilities of the Meccano System in the construction of humorous or quaint models are not generally realised, and indeed many model-builders never seem to make any attempts in this direction. This is a pity, because the building of such models is not only extremely amusing, but also it provides unlimited scope for ingenuity. In models of this type it is just as important to select the most suitable part for each special purpose as it is in building models of engineering prototypes. Still another point is that the completed models provide a great deal of amusement for one's friends.

On this page we reproduce three examples of quaint models from animal prototypes. Many other creatures could be portrayed in a similar manner, and a glance through any illustrated book of animals will provide plenty of suggestions. As a general rule no attempt should be made to reproduce the bodily shape of the creature, a flat form, such as is shown in the models illustrated here, being more effective. Generally speaking the model should represent a direct side view or a direct front view, three-quarter views being difficult to reproduce, and apt to be disappointing when completed.

The stork shown in Fig. 1 is a typical example of a side-view model, and a moment's consideration will show that it would be impossible to build it in any other manner to produce a better effect.

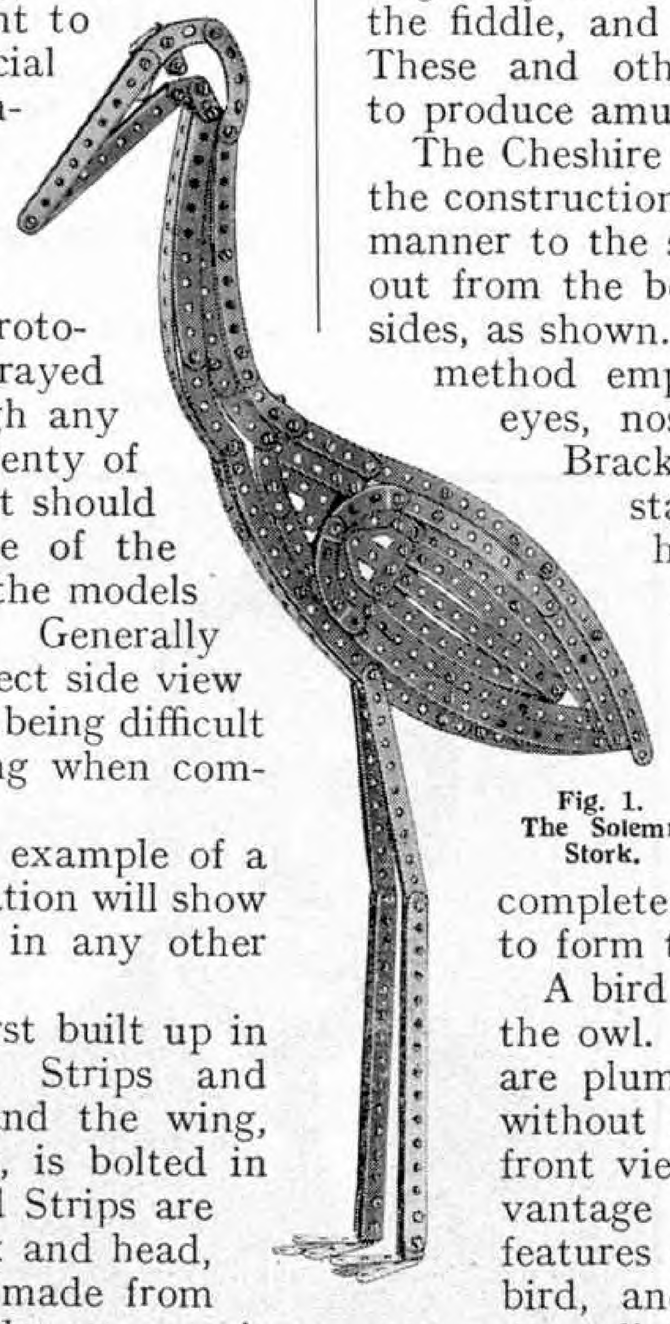


Fig. 1. The Solemn Stork.

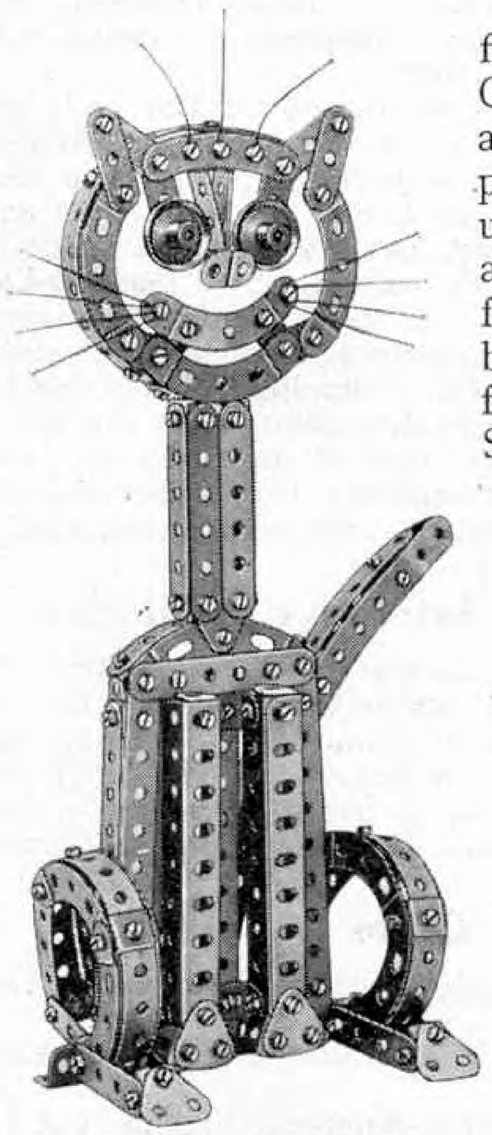


Fig. 2. The Cheshire Cat.

The body is first built up in flat form from Strips and Curved Strips, and the wing, also in flat form, is bolted in position. Curved Strips are used for the neck and head, and the beak is made from four $4\frac{1}{2}$" Strips, the upper pair being placed edge to edge to form an inverted V section. Strength is given to the body, neck and head by curving Strips to the shape of the outline, and fixing them in position by Angle Brackets. The legs are made from pairs of $5\frac{1}{2}$" and $7\frac{1}{2}$" Strips attached at the lower ends to Single Bent Strips, to which the feet are bolted. Wood Screws may be passed through the Single Bent Strips and the short Strips forming the feet, and screwed into a baseboard to hold the model erect. This should be done before the legs are bolted to the Single Bent Strips.

The subject represented in Fig. 2 will not be found in any books on zoology, but we think all who have read "*Alice in Wonderland*" will recognise it immediately. This example shows that the constructor need not confine his activities to actual animals, for many suitable and amusing subjects are to be found in fables, nursery rhymes, numerous books, and elsewhere. Model-builders might try their hands, for instance, at the cat that played the fiddle, and the cow that jumped over the Moon! These and other similar subjects would be certain to produce amusing models.

The Cheshire cat in Fig. 2 requires little description, the construction being carried out generally in a similar manner to the stork. The fore legs are made to stand out from the body, and the hind legs are fixed at the sides, as shown. Particular note should be made of the method employed for reproducing the face. The eyes, nose and mouth are fixed by means of Brackets and Strips at the back, so that they stand out prominently. The Set Screws have been removed from the 1" Pulleys forming the eyes, and replaced by Grub Screws that grip $\frac{3}{8}$" Bolts that are passed through $1\frac{1}{2}$" Strips. Two Angle Brackets form the nose, and a Curved Strip, representing the mouth, produces the grin without which no Cheshire cat could be considered complete. Stiff wire is arranged as shown to form the whiskers.

A bird that contrasts strongly with the stork is the owl. In this case the distinguishing features are plump body, short legs, large head, almost without neck, and large round eyes. A direct front view shows to advantage the quaint features of this peculiar bird, and Fig. 3 illustrates a realistic model that has all the chief owl characteristics. The body, head and wings are all in the same plane, and are built up from Curved Strips. The body is filled in with Strips, and three $1\frac{1}{2}$" Strips are used for each foot, which is fixed in position by means of an Angle Bracket. A novel use has been found for Dunlop Tyres, which are fitted to the 1" Pulleys forming the eyes. The Pulleys are held in place by 1" Screwed Rods threaded into the tapped bores, and fixed to Angle Brackets bolted behind the head. The beak is fixed in place by a $\frac{1}{2}$" Bolt.

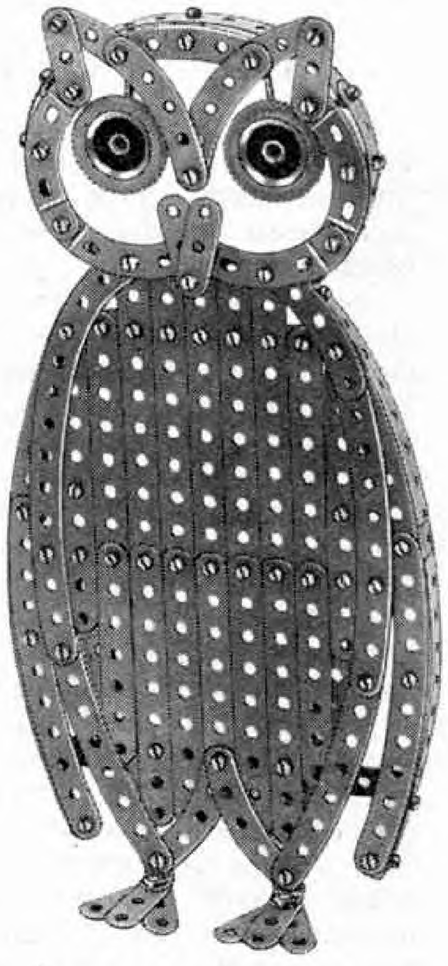


Fig. 3. A Wise Old Owl.



A Merry Christmas

Once more we have reached what is to Meccano boys, and indeed to all boys, one of the happiest seasons of the year, and it is with great pleasure that I wish a Merry Christmas to members of the Meccano Guild throughout the world. It is always a source of pride to me that my greetings extend to every corner of the Earth, for the Guild now includes nearly 100,000 devoted adherents, and there is scarcely any country in which it is not represented. There are flourishing clubs in Australia, New Zealand, India and South Africa, as well as in practically all European countries, and during the past year wonderful progress has been made in Canada and South America.

Evidence of the value placed by officials on the influence of Christmas in encouraging friendship and goodwill is to be found in every report that I receive during the first of the winter sessions, for practically every club programme is designed to lead up to an Exhibition or Social Evening arranged for the holiday season. Whatever form Christmas festivities take, they help members to get to know each other better, and it is splendid to read in letters from Leaders and secretaries of the happy times spent in indoor games and sports of all kinds.

Music in Club Life

Community singing often plays a great part at such social gatherings and in many clubs small orchestras have been formed, with the effect of brightening things up considerably. I should like to see more of this, and shall always encourage the introduction of musical evenings or of half hours devoted to club singing. There is no necessity for an elaborate organisation for this purpose. Wonderful things can be done with a piano accordion, and the growing popularity of this instrument suggests the possibility of the formation of accordion bands in Meccano clubs. Officials of clubs numbering instrumentalists of any kind among the members should think over these suggestions.

The holiday season also is a good time for the introduction of variety into the programmes by arranging special demonstrations. The value for this purpose of the Kemex and Elektron Outfits should not be overlooked. The striking and attractive experiments that can be performed with their contents are always of interest when carried out in a straightforward manner, but the fun is increased when spectacular results are obtained by means of that are not apparent to the onlooker. The articles on chemical and electrical magic appearing in the present issue of the "*M.M.*" show what can be done on these lines.

Meccano Club Leaders

No. 69. Mr. S. H. Wilson



Mr. Wilson has been Leader of the Holy Trinity (Barnsbury) M.C. throughout its long career. The club was affiliated in October, 1919, and under Mr. Wilson's able guidance, the enthusiasm of members has been splendidly maintained and developed by means of attractive and varied programmes. A special feature is made of the club's Annual Exhibition, which is planned on an extensive scale and attracts large numbers of appreciative visitors, including many members of other London clubs.

The Oldest Club in the Meccano Guild

The Holy Trinity (Barnsbury) M.C. was affiliated as long ago as October, 1919, and all connected with it are proud of the distinction it possesses of being the oldest club in the Meccano Guild.

The club is fortunate in its association with the Holy Trinity Church, for this ensures an excellent club room and the valuable interest of the Vicar and other influential people, who greatly appreciate its importance in their social work. It is even more fortunate in its Leader, Mr. S. H. Wilson, who has directed its activities since its foundation. Its remarkable progress is due almost entirely to his wise guidance and unflagging energy, and to his power of arousing in officials and members alike the desire to make their club an outstanding success.

Meccano model-building and engineering topics have always been prominent in the programmes, and interest has been added by means of a wide variety of hobbies, together with Lantern and Cinematograph Shows, Competitions and Debates. Skilful use has been made also of Social Evenings and Exhibitions, and the interest shown by visitors on these occasions has encouraged members to continually greater efforts.

The organisation of the club has been a matter for careful thought. Senior and Junior Sections have been formed, each with its own Leader and Secretary, and every effort is made to run both sections in a business-like manner. A special feature has been made of encouraging members to share in the task of running the club, and by trusting in their ability to do this one of the great aims of the Guild has been achieved, namely, that of fostering the initiative and resources of Meccano boys.

An Attractive Exhibition

The Kendal M.C. is holding its Annual Exhibition in the Toc H Rooms, Stramongate, on Friday and Saturday, 8th and 9th December. On Friday the Exhibition will be open from 6 p.m. to 9.30 p.m. and on Saturday from 2.30 p.m. to 9 p.m. The charge for admission is 4d., children half price.

Proposed Clubs

BIRKENHEAD—H. F. Payne, " Langwith," Mount Pleasant, Oxton, Birkenhead.

KIDDERMINSTER—W. G. Evans, 17, Mortimer Terrace, Cleobury Mortimer, Kidderminster.

LONDON—L. Dellow, 47, Linden Grove, Nunhead, London, S.E.15.

LONDON—P. A. Bryett, Pembroke, Friary Way, North Finchley, London, N.12.



Bagshot and Lightwater M.C.—A very successful summer session concluded with a visit to Brooklands, where the works of Vickers Ltd. were inspected, aeroplanes of several types being examined at different stages of construction. The mountain railway laid down outdoors on the side of a hill has now been dismantled, and the indoor track relaid. Model-building Evenings alternate with Hornby Train Nights. Social Evenings are being arranged, at which it is hoped to welcome new members and the secretary will be pleased to hear from those wishing to join. Club roll: 12. *Secretary:* P. Herridge, Cypress Cottage, Guildford Road, Bagshot.

Dagenham M.C.—Efforts are being made to break the attendance record, and members are so enthusiastic that this attempt seems certain to be successful. Model-building and Hornby Train Sections have been formed under the control of leaders who are responsible for making plans and keeping members busy. Mr. W. H. Bond, Leader of the club, works with each group in turn and gives short talks on points of special interest. New members will be cordially welcomed. An Electrical Section also has been formed. Club roll: 30. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham.

Exeter M.C.—One of the club's two workshop models has been demolished in order to release the parts for further Model-building. New machines in the remaining workshop include a 10-ton press and a lathe on which very light work, such as buffing gear wheels, can be carried out. Model-building is being carried on with great enthusiasm, the models built including truck tipping gear, a swivelling crane, a dredger, various types of aeroplanes, and locomotives designed to run on Hornby Train track. A Meccano turbine has been built by the joint Leaders. This revolves at high speed, and its inclusion adds to the impressiveness of the scene when the workshop and other club models are working together. Club roll: 27. *Secretary:* D. Legg, 25, Chute Street, Exeter.

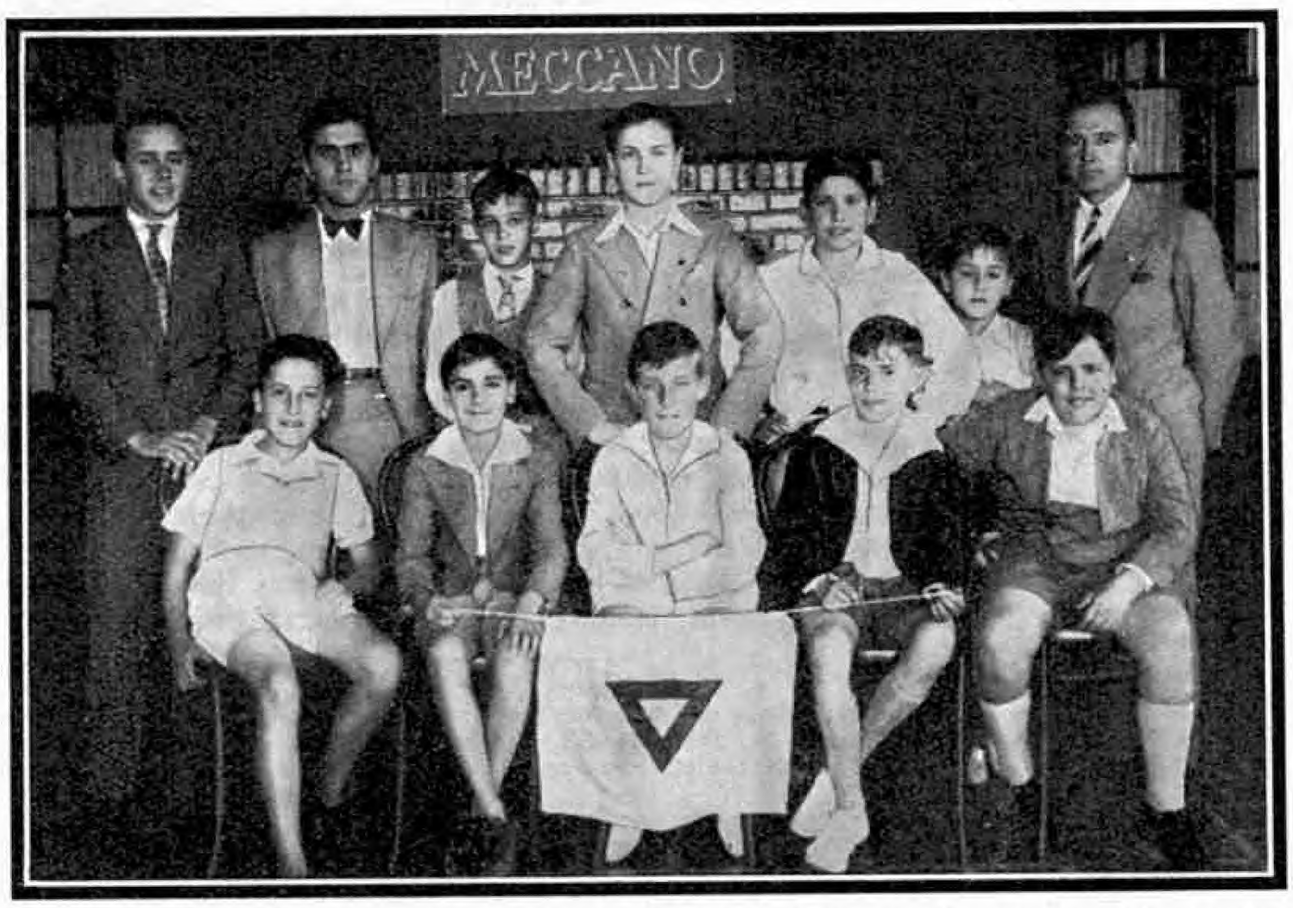
Harlesden Methodist M.C.—Preliminary work on plans for the winter sessions kept members busy for several meetings. This work included cutting up planks to form base boards for the club track. Model-building activities were resumed as soon as possible and the excellent models now completed include a motor lorry chassis, a representation of a Green Line omnibus, and a printing machine. The Library is open after club hours and members display great interest in the Magazines available. Mr. Poole has kindly undertaken the duties of Assistant Leader. Club roll: 7. *Secretary:* J. A. Ford, 139, Wakeman Road, Kensal Rise, London.

Whitgift Middle School M.C.—A record number of new members has been enrolled this session and active recruiting is still in progress. Visits have been made to Southampton Docks and to the recent Engineering Exhibition at Olympia, where members were particularly interested in the searchlights and gyroscopes, and in machines that suggested good subjects for model building. The Hornby Railway Section has held speed and endurance tests for members' locomotives. Club roll: 51. *Secretary:* G. Cakebread, 12, Beech Road, Norbury, S.W.15.

Bridport Grammar School M.C.—The establishment of a central store from which Meccano parts may be borrowed by members has proved a great success, and interest in Model-building has been stimulated, for the extra parts required for building ambitious models are now available. It has become necessary to enlarge the Library owing to the great demand for books, and the proceeds of a Lantern Lecture are to be devoted to this purpose. Several new members have been enrolled, and a bright programme has been arranged. Club roll: 35. *Secretary:* E. Wilkins, 76, St. Andrew's Road Bridport.

Greenock Academy M.C.—The programme for the winter sessions has been very carefully planned in order to lead up to a record Exhibition early in 1934. Special efforts also are to be made to encourage junior members, for it is realised that the continued success of a club depends on an adequate supply of recruits. The younger boys in the school are responding well to these efforts. The "*Stockwell*," a vessel discharging linseed to the British Oil and Cake Mills, has been visited, and this was followed by an inspection of the Oil and Cake Mills themselves. Very attractive visits to sugar refineries and motor car tyre factories have been arranged. Club roll: 30. *Secretary:* D. M. R. Steel, 25, Margaret Street, Greenock.

St. Nicholas (Sevenoaks) M.C.—Novel meetings have been arranged for the winter sessions, and special attention is being paid to photography. A special feature is to be made of impromptu social evenings, such as "Half Pound Night," when each member brings this weight of nuts, biscuits or other things good to eat. Model-building and games form the chief attractions at ordinary meetings. Club roll: 14. *Secretary:* J. Kemp, 2, Bosville Road, Sevenoaks.



Members of the Montevideo M.C., with Sr. H. Canziani B., Leader of the club, on the left in the back row. The club was affiliated in March of this year and has held two successful Exhibitions, the second of which was open to the public for a week and attracted 500 visitors.

Middlesbrough M.C.—A Club Magazine is being produced, the Editor, Mr. W. D. Allick, being supported by an enthusiastic staff. Inter-section tournaments at Table Tennis and Blow Football have been held, these being won by the "Clips" and the "Rods" respectively. Club roll: 28. *Secretary:* L. Weighell, 42, Bishopton Road, Middlesbrough.

The New Bradwell M.C.—The summer session ended with a week's camp near Leighton Buzzard, and the enjoyment of those who took part in this was not marred by the continuous rain experienced. Meetings in the Club Room have now been resumed, a splendid programme of Model-building Contests and other attractions having been arranged, and a Hornby Train layout constructed. Trial football matches have enabled a good club team to be chosen and good winter sport is anticipated. Indoor recreations include Table Tennis and Bagatelle. Membership is increasing in a satisfactory manner. Club roll: 39. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley.

Whitgift School M.C.—There has been a record attendance of new members, no fewer than 26 having joined the club this session. Model-building Evenings have been held regularly, and joint meetings with the associated branch of the H.R.C. have been arranged for Hornby Train operations. The Fairfield Telephone Exchange has been visited, and a Lantern Lecture, "*The Story of the London Omnibus*," has been given, slides being kindly loaned by London Transport. Club roll: 54. *Secretary:* H. J. Kirby, "Minniscot," Riddlesdown Avenue, Purley.

Gate House (Ingatestone) M.C.—Preparations are in progress for the club's annual Christmas display. A special feature will be a Model Coaching Station, produced by the joint efforts of the Fretwork and Hornby Train Sections. Members have built up a scene to represent an invasion. The models in this include bombing planes, which fly over a realistic representation of country scarred by enemy trenches, and troop trains play a great part in the scheme. Club roll: 16. *Secretary:* S. Wood, "Gate House," Ingatestone, Essex.

Worcester Y.M.C.A. M.C.—Affiliation has now been secured and members are very keen. Meetings are held on Saturday evenings and are devoted alternately to Model-building and Hornby Train operations. On other nights members are allowed to take part in gymnasium work, and the club rooms are then available for model building or games. *Secretary:* R. G. Price, 60, Bath Road, Worcester.

NEW ZEALAND

Blenheim M.C.—At a successful "Surprise Night," members played games before receiving their real surprise in the form of a splendid supper! Afterwards prizes won in games were presented, together with those earned by members in Model-building Competitions and other Contests. Other meetings have included a Simplicity Contest and Games Night, marks in the sessional competitions being awarded in each case. Club roll: 21. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

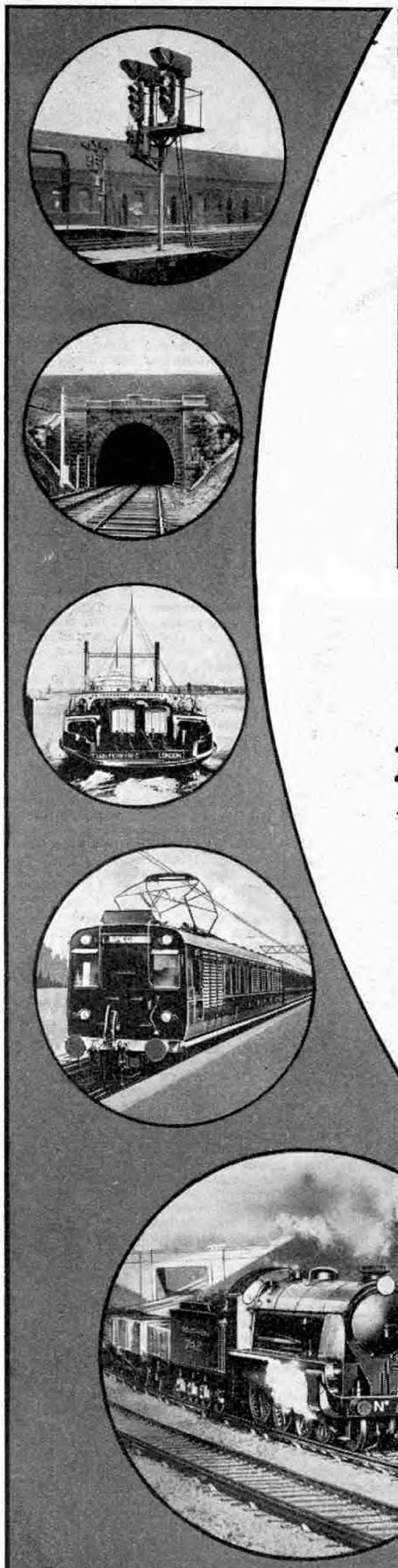
Wellington Boys' Institute.—Mr. E. Speers, formerly Secretary of the club, has been elected an honorary life member. He concluded his official connection with the club by giving an interesting Lecture on the "*Early Tramcars of Melbourne.*" Model-building and work on the club's Hornby Train layout have been varied by a meeting at which difficult jig-saw puzzles were tried. On Hornby Train Evenings locomotives are provided with headlamps and the coaches are lighted electrically. The result is very realistic, especially when the lights in the club room are switched off. A copying machine has been purchased and this is being used in the production of the new club magazine. Club roll: 25. *Secretary:* A. Abel, 17, Helen Street, Brooklyn, Wellington, New Zealand.

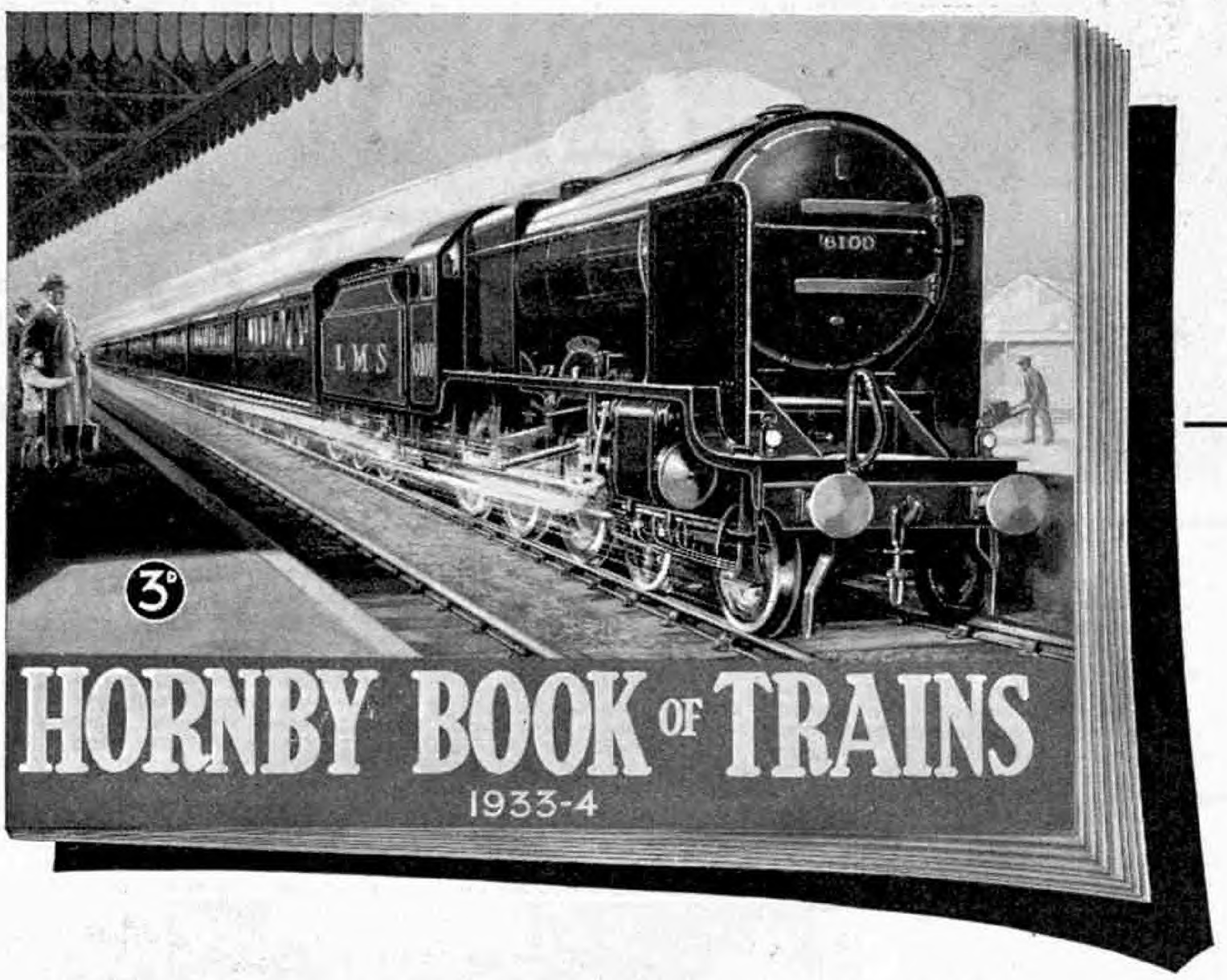
SOUTH AFRICA

Western Province Preparatory School M.C.—At a very enjoyable "Contractors Evening" four sections or "firms" tendered for the construction of a bridge. The successful contractors erected a cantilever bridge similar to the famous structure across the St. Lawrence at Quebec. Excellent progress has been made in general work, and interest in the construction of original models becomes keener as the club roll increases, and members become more skilful. Club roll: 50. *Secretary:* B. B. Strickland, "Engwood," Doris Road, Claremont, South Africa.

Club Not Yet Affiliated

Chandlersford (Hants) M.C.—Meetings are being held in a convenient club room and excellent model-building is in progress. A Library has been formed. This is organised efficiently and is very useful to members. Meccano boys living in the neighbourhood who wish to join should write to the Secretary: C. Kemp, 6, Meadow Crescent, Chandlersford, Hants.





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NEW ZEALAND: Models Limited, P.O. Box 129, Auckland C1 (Third Floor Paykel's Building, Anzac Avenue).
SOUTH AFRICA: Arthur E. Harris 142, Market Street, Johannesburg (P.O. Box 1199).
CANADA: Meccano Ltd., 34 St. Patrick Street, Toronto.

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A Century of Railway Development

Steps Toward Present-Day Services

A NOTABLE feature of this year has been the successful inauguration of the first electrified main line service in this country—that of the Southern Railway to Brighton. It is an opportune time, therefore, to review the progress that has been made in railway electrification in this country.

The first electric railway in the British Isles was the Giant's Causeway Electric Railway in Northern Ireland, and it was the first hydro-electric railway in the world. It celebrates its jubilee this year, having commenced operations in 1883. The first overhead electric railway in the world was the Liverpool Overhead Railway, and the wonderful system of London "tube" railways has developed from the original City and South London line, which was the first "tube" in the world. These underground railways have a remarkable safety record, in spite of their dense traffic, and this is the result of the special and elaborate measures taken to ensure safety under all conditions.

Of the large groups, the greatest variety in electrification is provided by the L.M.S.R., resulting from experiments made by several of its constituent companies prior to grouping. The company are joint owners with the L.N.E.R. of the interesting Manchester, South Junction and Altrincham line, the first to conform to the requirements of the Government Committee appointed in 1927 to formulate a schedule for future electrifications. It is the first passenger line to be equipped with the overhead wire 1,500-volt direct-current system recommended by the Committee.

The systems mentioned so far employ trains of the motor coach type, but the London Metropolitan line employs in addition, separate locomotives for special duties, both passenger and freight. On the L.N.E.R. separate locomotives are used in the Newcastle and Shildon areas for freight traffic only, the engines in the latter district having overhead wire equipment.

With present-day railway developments succeeding each other so rapidly, we are liable to forget the gradual process of railway evolution that has taken place during the past century. After the triumph of the earliest lines, in spite of determined opposition, there followed the extraordinary period known as the "Railway Mania," during which in 1846 no less than 272 Acts sanctioning the construction of new lines were passed by Parliament. Then came a time of steady progress, and among interesting developments that have had considerable subsequent effects was the invention of water pick-up apparatus. Without this device our modern long non-stop runs would be impossible, yet it was invented as long ago as 1860. The steamer services now operated by our four groups have sprung from the service between Grimsby and Hamburg that was started in 1865 by the one time Manchester, Sheffield and Lincolnshire Railway. The abolition of second-class travel, the improvement in third-class accommodation, and the introduction of Pullman cars into this country were effected by the Midland Railway during the seventies.

The running of the "*Cornish Riviera Express*" non-stop from Paddington to Plymouth in 1904 was an important step towards the modern era of long-distance travel, and the all-Pullman "*Southern Belle*" of 1908 was a forerunner of the luxury trains of to-day. The most famous British examples of the latter—"*The Royal Scot*," "*The Flying Scotsman*," the "*Cornish Riviera Express*" and "*The Golden Arrow*"—embody the experience of a century of development with the most modern technical improvements.

A striking feature of British railways is the great variety of goods wagons employed for the different kinds of traffic. Although the standard goods vehicle in this country is the four-wheeler of relatively small capacity, larger wagons are in use where conditions are favourable for their employment, notably for the carriage of coal or minerals. These freights are usually conveyed in bulk consignments, and facilities for their rapid discharge form an essential feature of such wagons.

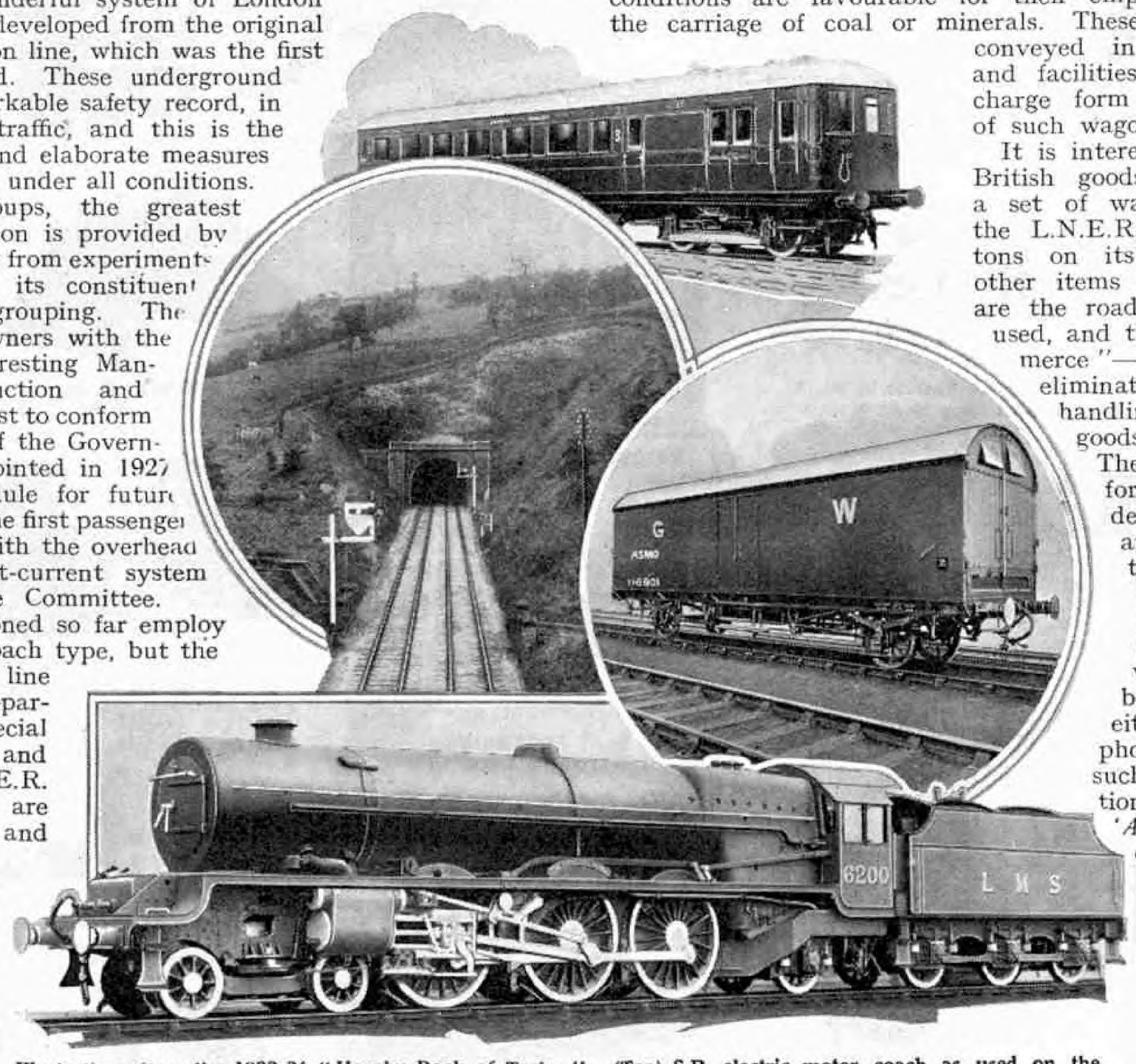
It is interesting that the largest British goods vehicle is actually a set of wagons. It belongs to the L.N.E.R. and can carry 150 tons on its 56 wheels. Among other items of particular interest are the road-rail milk tanks now used, and that "suitcase of commerce"—the container—that eliminates so much unnecessary handling and repacking of goods.

The system of code names for different vehicles, developed by the G.W.R. and L.N.E.R., is particularly interesting. The use of these names saves considerable time and trouble when the wagons concerned are being ordered about by either telegraph or telephone, and accounts for such mysterious inscriptions as "*Macaw*" or "*Asmo*" on G.W.R. stock, or references to an L.N.E.R. "*Miser*" or "*Boplate*"!

On a railway journey we are able to observe how the formation of the land affects the line, and thus has its influence on the task of the engineer. A railway over fenland is necessarily carried on a low embankment to ensure good drainage, and is invariably level and straight. On firmer ground gradients make their appearance and curves become more frequent, in order to follow the lie of the ground, to serve certain places better, or to make good crossings of rivers and roads.

The relative costs of cuttings, retaining walls and tunnels, or viaducts and embankments, and the nature of the soil he is dealing with, have their effect in the form of construction decided upon by the engineer. Limestone, chalk, and sandstone cuttings can have almost vertical sides, but in a limestone district the changes in such railway scenery are more abrupt and varied than is the case in a chalk district, where the regular formation of the cuttings is monotonous. The sides of clay cuttings have to be drained efficiently, and this accounts for the stonework patterns apparently laid on the surface of the banks. Actually these stone courses cut down many feet into the slope to collect the water, and lead it to lineside drains.

All these topics are fully dealt with and profusely illustrated in the 1933–34 edition of the "*Hornby Book of Trains.*"

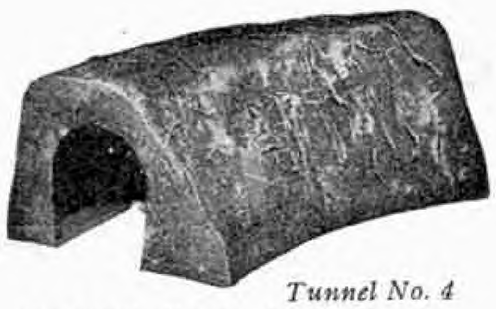


Illustrations from the 1933-34 "Hornby Book of Trains." (Top) S.R. electric motor coach as used on the Brighton services. (Centre, left) Cowburn Tunnel on the L.M.S.R., 2 miles 182 yards long. (Centre, right) A special G.W.R. motor car van known by the code name "Asmo." (Bottom) L.M.S.R. No. 6200 "The Princess Royal," the first "Pacific" locomotive to be built by that company.

HORNBY ACCESSORIES

There is a splendid range of Railway Accessories in the Hornby Series, all built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

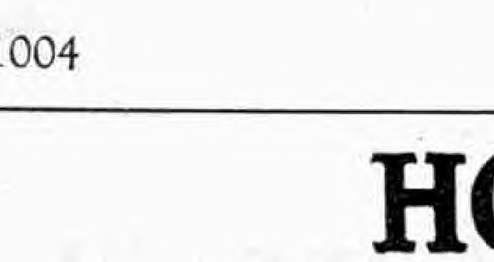
A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



Tunnel No. 4

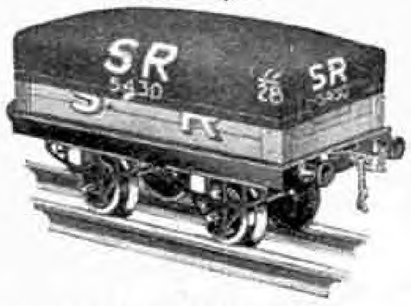
TUNNEL No. 3. (Curved)
For 2 ft. radius tracks only
Length 13 in. Price **4/6**

TUNNEL No. 4. (Curved)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**



BUFFER STOPS No. 2 (HYDRAULIC)
Price **5/6**

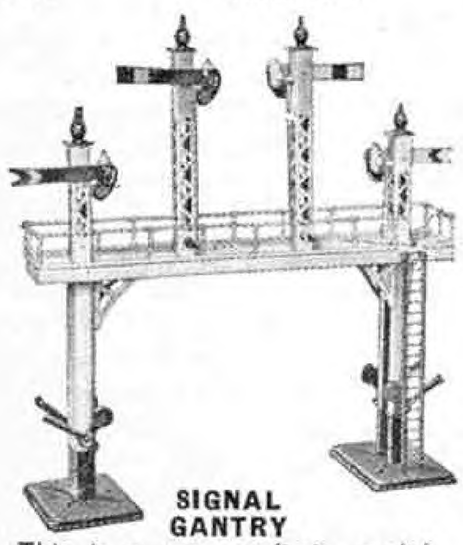
TURNTABLE No. 2
Price **4/6**



TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **3**d.



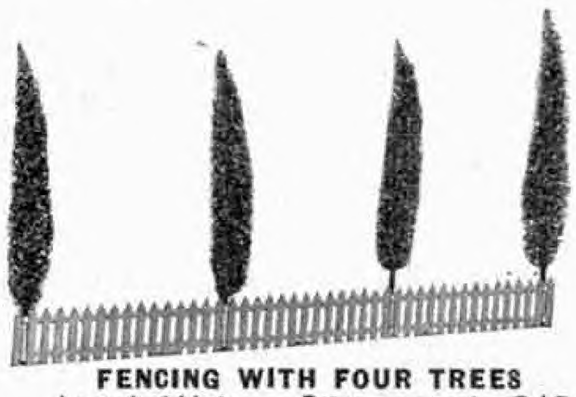
HOARDING, STATION
This is a realistic accessory, suitable for the station platform. Price **8**d.



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

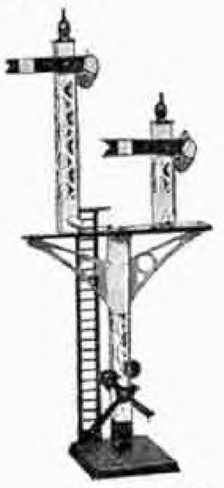


M STATION SET, 7 pieces
Price complete **3/-**
The components of the M Station Set may be purchased separately as follows :—M Wayside Station. Price, each **10**d.
M Signal Box ... Price, each **4**d. M Signals ... Price, each **4**d.
M Station ... ... Price, each **1/-** M Telegraph Poles No. 1. Price, each **3**d.

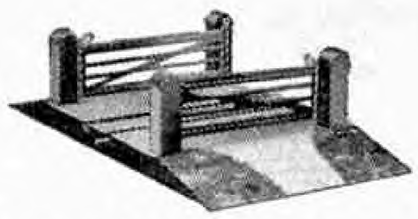


FENCING WITH FOUR TREES
Length 16½ in. Price per pair **2/6**
TREES { Oak Trees. Price **2½**d. each
Poplar Trees. „ **2**d. each
DIE-CAST STANDS FOR TREES
Price **1**d. each.

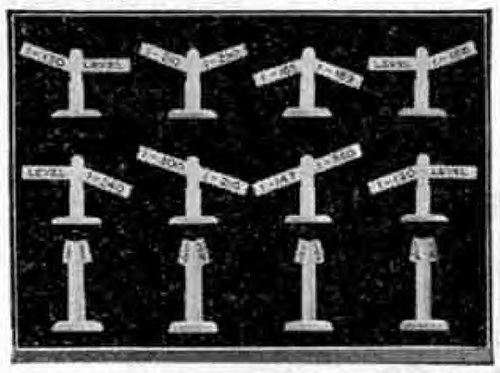




JUNCTION SIGNAL
"Home" or "Distant," Signal arms operated by levers at base.
Price **6/-**



LEVEL CROSSING No. 1
Suitable for a single track only. Gauge 0 rails in position.
Price **3/6**



RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/-**



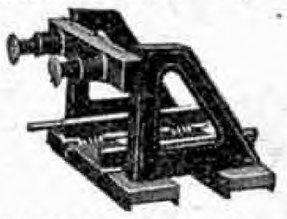
TUNNEL (Metal)
Price **5/9**



FOOTBRIDGE No. 3 LATTICE GIRDER
Constructional type. Strong and well proportioned. Price **10/6**



No. 1 FOOTBRIDGE WITHOUT SIGNALS
Price **4/-**
No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**
No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**



BUFFER STOPS No. 1
(Spring type.) Price **1/-**



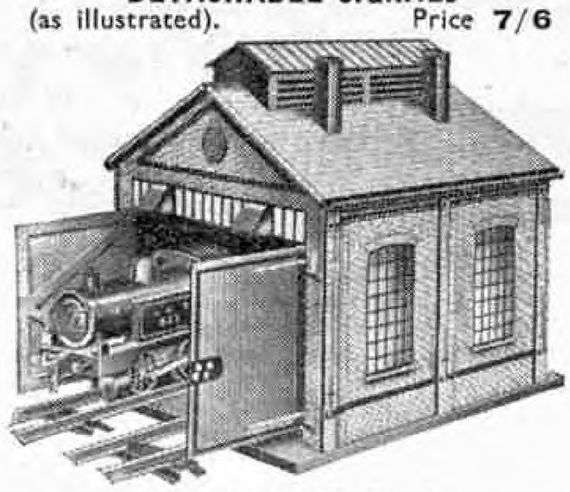
CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement : Length 15⅜ in. width 15 in. Price **6/-**



SIGNALS, DOUBLE ARM No. 2
Price **3/-**



RAILWAY ACCESSORIES No. 1
Miniature Luggage and Truck.
Price **1/6**



ENGINE SHED No. 1
This Shed will accommodate Locomotives and Tenders of the M Series, and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/-**



WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever.
Price **8/6**



PLATELAYER'S HUT
Price **2/-**



STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections.
Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**

SIGNAL CABIN No. 2
Dimensions : Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **4/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13



Branch Notes

ILKESTON AND DISTRICT.—The winter season opened with a recruiting campaign, all members of the H.R.C. in the district being invited to join the Branch. Track meetings have been held and preparations are in progress for making a special layout for operation at the forthcoming Exhibition. Secretary: F. B. Caddick, "Woodthorpe," Catherine Avenue, Ilkeston.

SHEFFIELD.—The Branch track has been completely relaid, and is now continuous, with a three-road terminus and two passing stations. Timetables for a joint L.N.E.R. and L.M.S.R. service have been worked out. The Sheffield L.N.E.R. Locomotive and Repair Sheds have been visited. Members inspected an "Atlantic" of G.N. type, the working of the superheater being explained from the footplate, and great interest was taken in the electric chute for recoaling locomotives. At one meeting a Cinematograph Exhibition provided a change from track work. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

WOODFORD.—Electric lights have been installed in the track room and the colour light signals are now supplied with current from a transformer. The track is being steadily extended and working improved by the introduction of accessories. A presentation was made to Mr. H. C. Martin, who has been Treasurer almost since the formation of the Branch. Secretary: J. H. Skelt, Walberswick, Woodside Road, Woodford Wells, Essex.

WIMBORNE GRAMMAR SCHOOL.—Work on the track continues and an interesting experiment in interlocking of signals has been carried out, the colour light signals at certain stations automatically showing a red light when the points do not give approaching trains a clear run, or when trains are entering and leaving the sections in which the stations are placed. Special attention also is being given to the painting of accessories, many of which are now painted white in order to increase visibility. Secretary: J. K. Bennett, 120, Newington Causeway, London, S.E.1.

WEST DULWICH AND HERNE HILL.—Track meetings have been varied by a discussion on signalling and by competitions. A type of contest that is very popular is called "Tit Bits." In this members are divided into teams and ask each other a series of questions on railway topics, marks being awarded for correct replies. Secretary: J. Nunn, 70, Herne Hill, London, S.E.24.

HOLLANDERS (SPALDING).—The Branch was reopened after the Summer holidays, under the direction of Mr. Keyworth, who has kindly accepted office as Chairman. Experimental tracks have been laid down and locomotive tests carried out, and Boxing, Wrestling and Games also have been included in the programme. A Library has been formed and the production of a Branch Magazine is being considered. Secretary: C. L. Redshaw, Devon House, Pinchbeck Street, Spalding.

ST. JOHN'S SCHOOL (LEATHERHEAD).—The Branch track has now been completed and three additional locomotives put into service. Members have been assigned special duties at track meetings. At present trains are being run without a timetable, each station master asking the next if he could receive a train before despatching it. At one meeting several accidents occurred, and a special enquiry was made. Secretary: P. W. Smith, Leatherhead School, Leatherhead, Surrey.

GROVE PARK.—The Branch room has been reconditioned and the track relaid. The formation and running of goods trains has been practiced and other track meetings have been devoted to the running of passenger and mixed traffic. The present Branch room is not very convenient, and the Secretary would be pleased to hear from anyone who is able to offer better accommodation. A proposal has been made to form a Stamp Section. Secretary: B. C. Chandler, 29, Ellesmere Road, Chiswick, London, W.4.



A merry group of members of the Caterham School Branch, No. 210. Chairman, Mr. K. C. Sparrow (in the centre of the group); Secretary, G. H. Dent. Track meetings are the chief attraction in Branch work, and a special feature is made of Lantern Lectures on railway topics.

AUSTRALIA

SYDNEY.—Amalgamation with the Parramatta Branch has been arranged. Meetings are to be held at the rooms of the Parramatta Branch, which has been greatly strengthened as a result of the union. The secretary of the Parramatta Branch will act in this capacity for the new organisation. Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W., Australia.

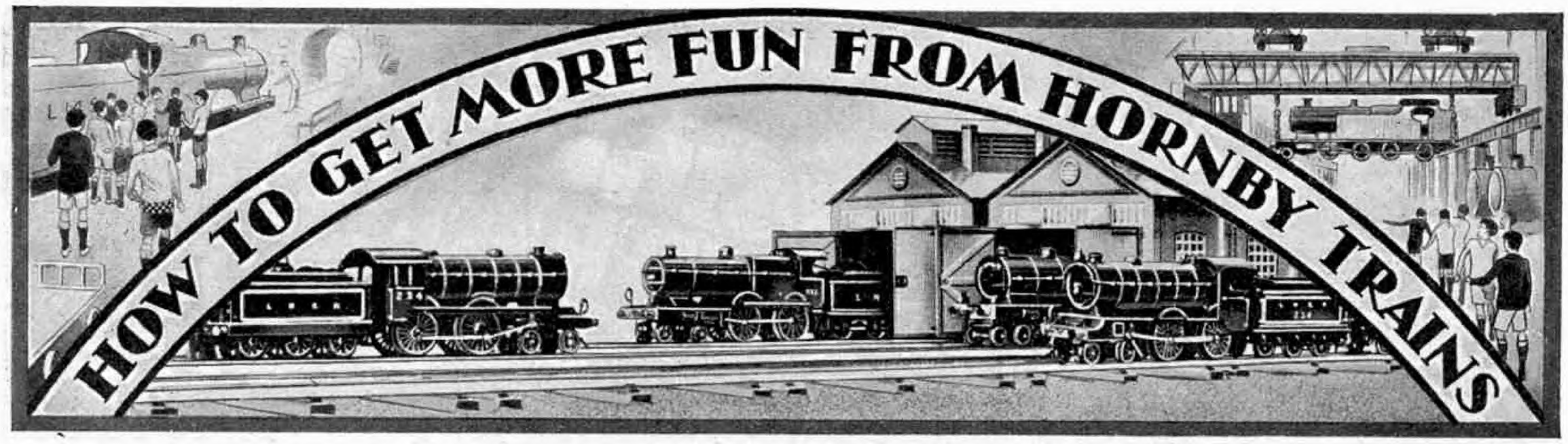
Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

CHELTENHAM—A. E. Crofts, Lloyds Bank House, Rodney Road, Cheltenham.
CREWKERNE—G. Long, Crewkerne School, Crewkerne, Somerset.
JOHNSTONE—R. C. Craig, "Roselea," Brookfield, Johnstone, Renfrewshire.
LYMINGTON—P. Dale, "Devona," Western Road, Lymington, Hants.
MANCHESTER—R. A. Owens, 18, Amherst Road, Fallowfield, Manchester.
MILLINGTON—A. Spooner, Middle Moss Farm, Ayden Lane, Millington, Nr. Altrincham.
NEW MALDEN—S. W. Hayes, 91, Burlington Road, New Malden, Surrey.
WESTCLIFF-ON-SEA—R. G. Emmett, Glendale College, Westcliff-on-Sea.

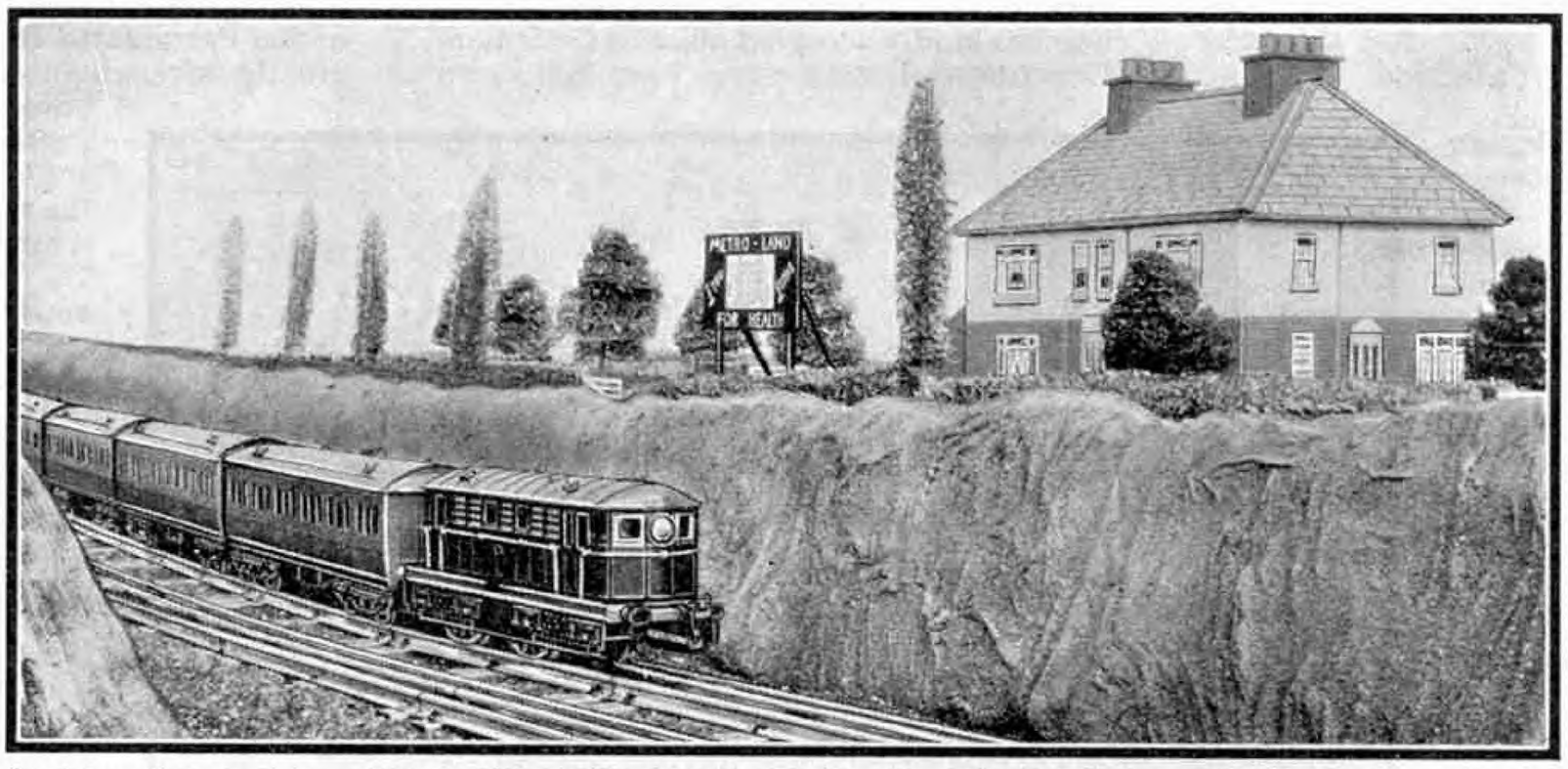
Incorporated Branches

249. SHEFFIELD—W. B. Hutchinson, 35, Linden Avenue, Sheffield 8.
250. CRAIGIE (PERTH)—R. Graham, 14, Glover Street, Craigie, Perth.
251. FINCHLEY—J. Price, 33, Windsor Road, Finchley, London, N.3.
252. HILLPLACE (CRAWLEY)—B. M. Delany, Purple Ridge, Colemans Hatch, Sussex.



LXII.—POSTERS ON HORNBY RAILWAYS

ONE of the most characteristic features of our railway stations is the display of posters, some devoted to purely railway matters, and others to all kinds of commercial products. These posters brighten up the appearance of a station to a remarkable degree, and to realise this it is only necessary to imagine what our local station would look like without them. We notice these posters most while we are walking up and down a station platform waiting for our train, and it is seldom that we fail to find something to interest us. The pictorial posters are designed by first-class artists, and are particularly attractive; while those that consist only of a phrase or a few sentences show striking ingenuity in the words chosen to deliver the desired message.

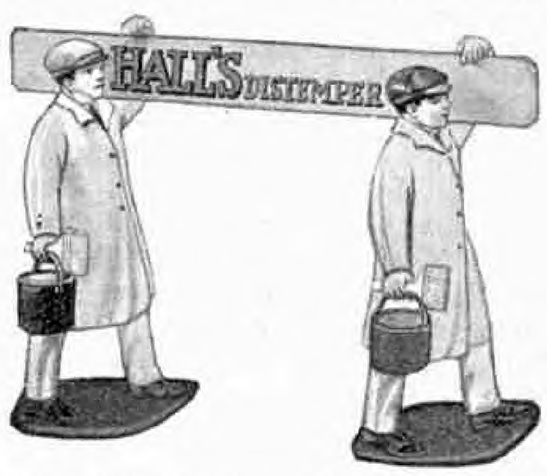


An interesting scene on a Hornby Metropolitan layout. The lineside notice board draws attention to the residential attractions of the district, as mentioned in this article.

In order to make it possible to reproduce this feature on the platforms of Hornby Stations a series of miniature Posters have been introduced. They are supplied in packets containing 51 different Posters, each one being a small-scale reproduction, in the original colours, of some well-known poster that is to be seen displayed on hoardings all over the country. The 51 Posters in each packet are of two sizes, measuring respectively $2\frac{5}{8}$ in. by 1 in. and $1\frac{1}{4}$ in. by 1 in., and each one is gummed on the back. In addition to the Posters each packet contains a sample Poster Board of suitable dimensions for displaying any of the smaller-sized Posters. This Board consists of a small metal plate provided with two hooked lugs at the top, by means of which it can be hung on the Hornby Paled Fencing, on Station Platforms, on Footbridges, or elsewhere.

Poster Boards are also obtainable separately in packets of six, three of a size suitable for the small Posters, and three suitable for use in the large ones.

Another interesting way of displaying the Hornby Posters is by means of the Station Hoarding. This is an attractively designed accessory that will accommodate one large Poster or two of the smaller ones. It looks exceedingly realistic and attractive on a Station Platform, but of course it need not be confined to such a position. It can be used to advantage in fields along the lineside, or in the roadways near the line, especially where Countryside Sections are in use on a layout.

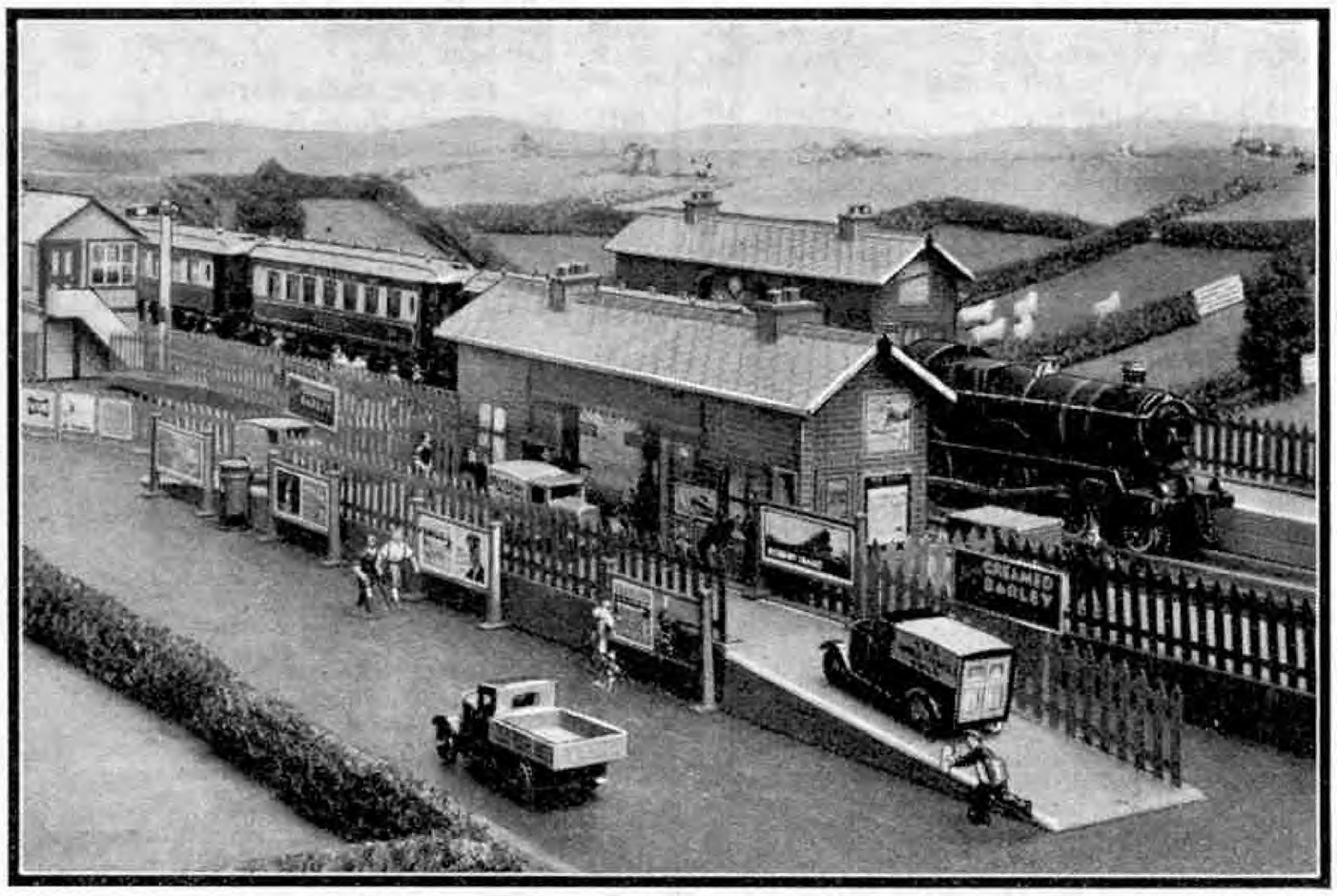


Modelled Miniatures No. 13, "Hall's Distemper." This is a novel accessory for lineside use.

Enterprising model railway owners may go still further, and instead of displaying their Posters singly or in twos, may erect miniature hoardings capable of holding anything up to a dozen or more Posters. Such hoardings are to be found almost everywhere nowadays, and they seem to become more effective every year. The miniature hoardings themselves may be quite simple constructions of wood, or even cardboard, painted in suitable colours and then covered with the selected Posters. These should not be plastered on to fill the hoarding completely, but should be carefully arranged with small spaces between them so as to form a symmetrical pattern. The spaces between the Posters then have the effect of forming neat frames, and in this manner the general appearance is greatly improved.

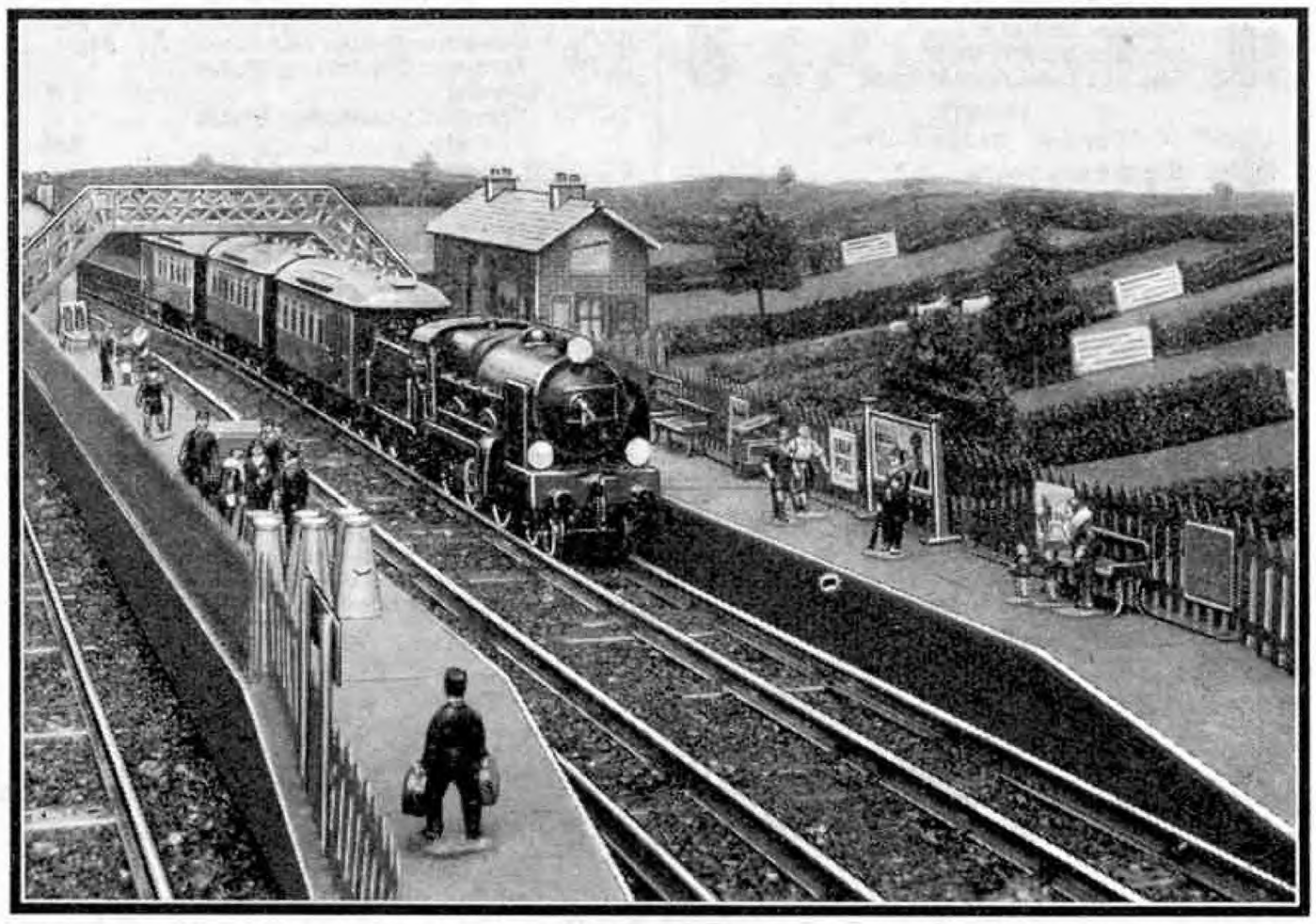
When housing estates are being developed in various areas, we often find that the attractions of the houses, and of the district as a whole, are set forth on large notice boards erected alongside the railway line. Schemes of this kind may be adopted with advantage by Hornby Railway owners. In many cases the standard Station Hoarding can be made to serve the purpose, or by

way of variety, special boards may be made as shown in one of the accompanying photographs. This photograph is particularly interesting as the London Metropolitan Railway have long been associated with residential developments in their area, so much so, in fact, that the name "Metro-Land" has come to be applied to the districts served by the railway. Miniature Metropolitan layouts, therefore, should follow up schemes of this kind as far as possible, for in this way very appropriate and attractive effects are to be obtained.



An unusual view of a Hornby Railway Station. The road approach to the Station offers splendid opportunities for the effective display of miniature Posters.

As part of the general scheme for bringing a miniature railway to the notice of the "inhabitants" in its area, the painting and lettering of the commercial vans of Modelled Miniatures No. 22 to represent railway road parcel vans may be carried out. A van in G.W.R. style treated in this manner is shown in one of our illustrations, and represents the latest addition to the road motor stock of that company. The usual brown and cream colouring is applied as shown in the photograph. The lettering may be done with black paint or with Indian ink, as preferred. Another commercial van shown in the same photograph bears the words "Meccano Magazine," and represents a newspaper van most realistically. The words may be cut from various items of Meccano literature and gummed on to the side of the van.



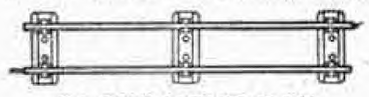
A typical wayside station on a Hornby railway. This photograph shows how the Poster Boards and Station Hoardings may be used to improve the realistic appearance of the platforms.

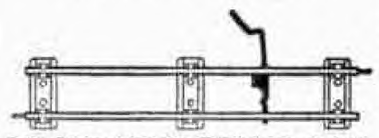
The open lorries in the Modelled Miniatures No. 22 can be made specially interesting by being lettered with the name of a local haulage contractor or coal merchant. Readers will remember that some time ago we suggested the use of Hornby Platelayers' Huts as coal offices with a name board of card attached to the roof. The delivery by road of the merchant's fuel may now be performed by these miniature lorries suitably lettered. Where there are several offices for different dealers, as often happens in a large coal yard, each office may have its own particular vehicle, and these will look extremely realistic coming and going in and out of the railway premises.

One of the best-known advertisements that are to be seen up and down the country along the railway is that of "Hall's Distemper." It shows two house painters in the white overalls and coats of their calling, carrying on their shoulders a plank bearing the words "Hall's Distemper." Each of them carries a bucket of this material and the appropriate brush. This interesting advertisement can now be seen alongside Hornby railways, for Modelled Miniatures No. 13 consists of two large figures representing the familiar painters with buckets and brushes complete, with a suitable "plank" with the words "Hall's Distemper" upon it for them to carry. This accessory is very striking and is particularly effective if due attention is given to its position. It should be used alone in a field, not in a spot where miniature railwaymen, passengers, or other people are likely to be placed. Otherwise, in spite of their size compared with the standard figures, much of the effectiveness of the "Hall's Distemper" men will be lost.

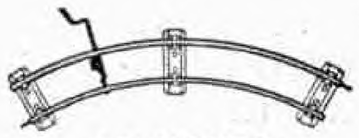
Apart from the attractive and interesting methods of advertising made possible by the use of the various Hornby Accessories mentioned in this article, it is possible to make use of many common items. Special posters announcing excursions, cheap fares and other facilities may be prepared by Hornby Railway owners. Portions of actual handbills, guide books or timetables are suitable for the purpose, and there is a wide selection of such material available nowadays. Coloured illustrations of trains and steamers may be adapted to draw attention to the attractions of rail or sea travel.

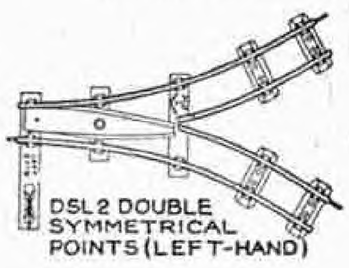
Hornby Rails, Points and Crossings

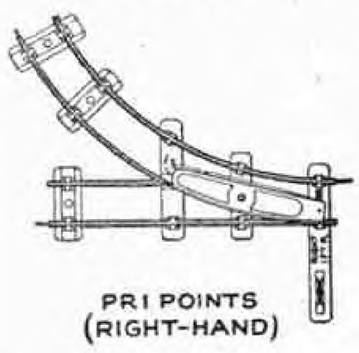

B1 STRAIGHT RAIL

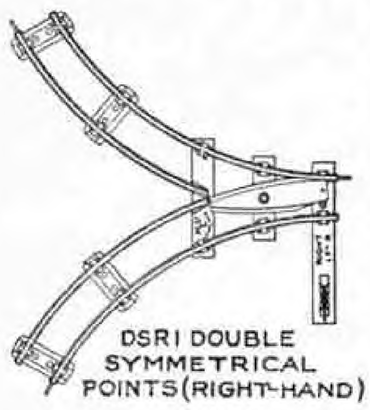

BB1 STRAIGHT BRAKE RAIL

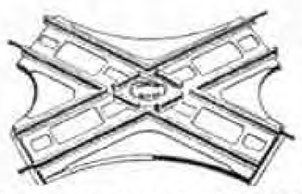

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA2 ACUTE-ANGLE CROSSING

Rails for Clockwork and Steam Trains, Gauge 0, 1¼"

CURVED RAILS

9-in. Radius (for M0 Trains)

M9	Curved rails	per doz.	3/–
MB9	Curved brake rails	each	3½d.

1-ft. Radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails ...	„	3/–
AB1	Curved brake rails	each	6d.

2-ft. Radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails ...	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for M0 Trains)	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails ...	„	2/6
BB1	Straight brake rails... ...	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track	½ doz.	6/6

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9

POINTS

9-in. Radius (for M0 Trains)

MR9	Right-hand points	per pair	3/–
ML9	Left-hand points		

For 1-ft. Radius Curves

PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		

For 2-ft. Radius Curves

PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair	5/–
PPL2	Parallel points, left-hand		
RCP	Rail Connecting Plates ...	½ doz.	2d.

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double symmetrical points, right-hand	per pair	5/–
DSL1	Double symmetrical points, left-hand		

For 2-ft. Radius Curves

DSR2	Double symmetrical points, right-hand	per pair	5/–
DSL2	Double symmetrical points, left-hand		

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair	12/–
COL2	Crossover points, left-hand		

Rails for Electric Trains, Gauge 0, 1¼"

CURVED RAILS

1-ft. Radius

EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails ...	„	4/–

2-ft. Radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails ...	„	4/–
EDC2	Curved rails, double track	½ doz.	9/–

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails ...	„	4/–
EDS1	Straight rails, double track	½ doz.	8/6

POINTS

For 2-ft. Radius Curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

CROSSINGS

ECA	Acute-angle crossings ...	each	4/–
ECR	Right-angle crossings ...	„	4/–

DOUBLE SYMMETRICAL POINTS

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

EPPR2	Parallel points, right-hand	per pair	8/6
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/–
ECOL2	Crossover points, left-hand		
TCP6	Terminal Connecting Plates (6-volt)	each	1/6
TCP20	Terminal Connecting Plates (20-volt)	„	1/6

Electrical Points for 1-ft. radius curves are not supplied.

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. Radius

AC1	Curved centre rails ...	per doz.	1/–
AC1½	Curved centre half rails ...	„	9d.
AC1¼	Curved centre quarter rails	„	6d.

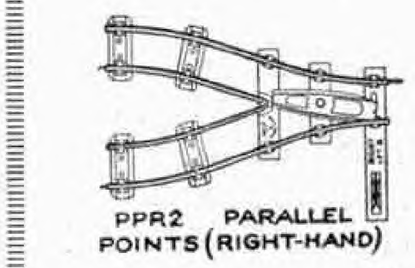
2-ft. Radius

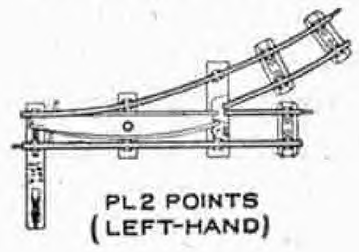
AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails	„	6d.

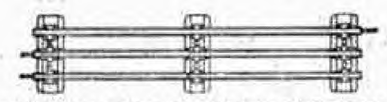
STRAIGHT CENTRE RAILS

BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	„	9d.
BC¼	Straight centre quarter rails	„	6d.
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails	„	6d.

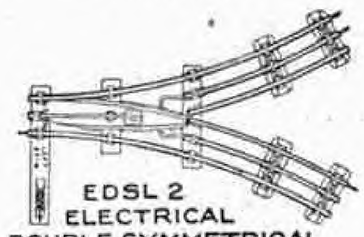
The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many interesting illustrations and much useful information is given in a booklet entitled "How to plan your Hornby Railway." This booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d. post free.

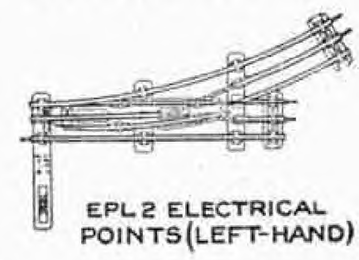

PPR2 PARALLEL POINTS (RIGHT-HAND)

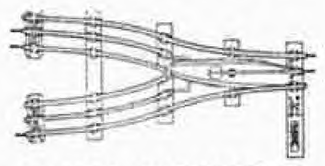

PL2 POINTS (LEFT-HAND)

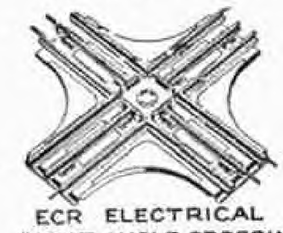

EB1 ELECTRICAL STRAIGHT RAIL


EA1 ELECTRICAL CURVED RAIL


EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)

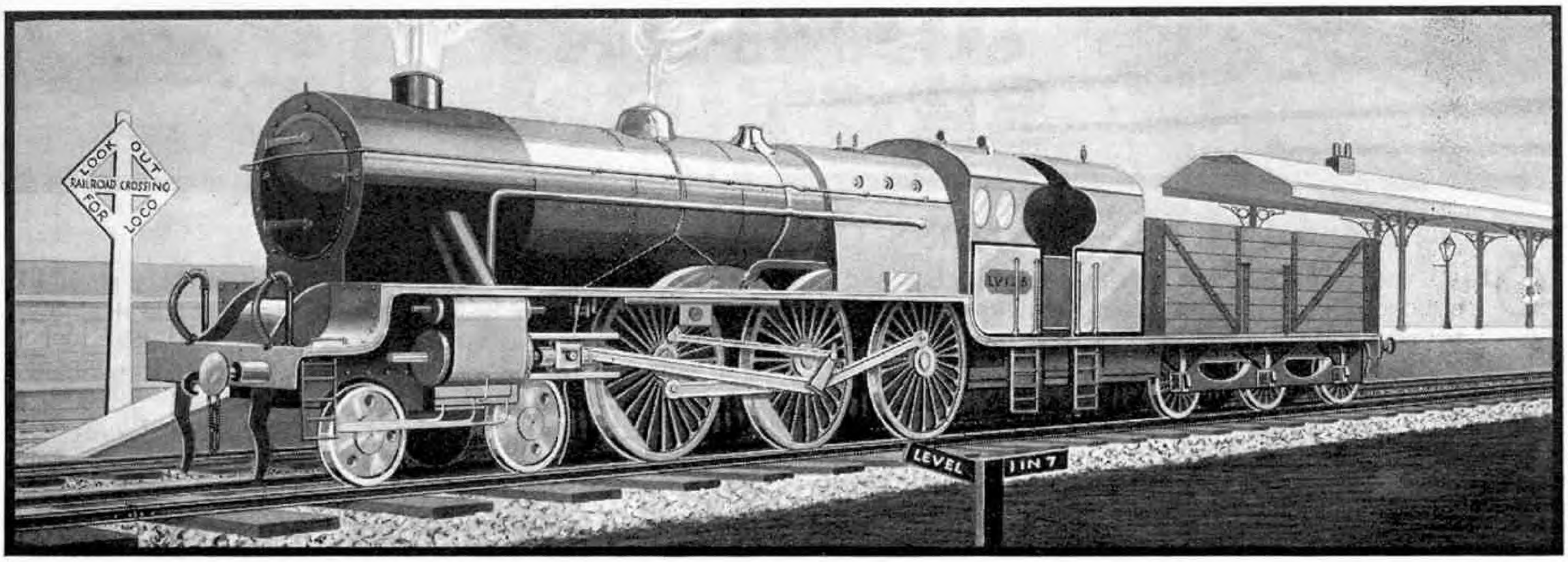

ECR ELECTRICAL RIGHT-ANGLE CROSSING

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H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Meccano Ltd., Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on the back of every sheet of paper used.

LOCOMOTIVE ERRORS CONTEST



The fascination of a powerful steam locomotive is never-ending, and the handsome giants now to be seen on our railways seldom fail to attract admiring glances from passengers of all ages. These monsters of the iron road are far more complicated than is usually imagined by those who have not studied them. A modern locomotive is much more than a fire-box and a boiler, together with cylinders and driving wheels. It carries in addition a number of devices, many of them small and unimportant-looking, yet each of which plays an essential part in enabling the engine to carry out its work efficiently and economically. It is in these devices that members of the H.R.C. are specially interested. They have almost an expert knowledge of them, and in our competition this month we provide an opportunity for this knowledge to be utilised.

Reproduced at the top of this page is an illustration of a giant locomotive, which at first glance appears to be an impressive 4–6–0. A second glance, however, will show that there is something wrong with the locomotive, and closer inspection will reveal that scarcely anything is right! In this competition we invite members to make a list of as many errors as they can find in the illustration. We may say at once that the mistakes are numerous, and many of them far from obvious. Competitors therefore will be well advised to scrutinise every portion of the illustration carefully.

When a competitor is sure that he has tracked down every error, he should make out a neat copy of his list on one side only of one or more sheets of paper as required, and forward this list to H.R.C. Headquarters at Meccano Ltd., Binns Road, Liverpool 13, in an envelope marked in the top left-hand corner "*H.R.C. Locomotive Errors Contest.*"

The competition will be divided as usual into two sections—Home and Overseas. In each of these the senders of the lists containing the largest number of genuine mistakes will be awarded Hornby Train goods (or Meccano Products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded to those competitors whose entries contain the greatest number of errors after the first four winners have been decided.

Entries from Home competitors must reach this office not later than 31st December. The closing date for competitors in the Overseas Section is 31st March, 1934.

Drawing Contest

In our last Drawing Contest, announced in the "*M.M.*" for July of this year, we allowed competitors to choose their own subjects, and as a result the entries were remarkable for their wide range and for their high quality. In its new form, the competition was very popular, and we have pleasure in announcing a similar Contest this month. In this, all that is required from competitors is that they shall send in a drawing of a subject possessing definite railway interest. This freedom from restriction gives great scope to members of the H.R.C. for it enables them to devote their energies to the branches of railway work in which they are most interested and with which they are familiar.

The competition will be divided into the usual two sections—Home and Overseas. To the competitors who submit the four best entries in each of the two Sections will be awarded prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded to those competitors whose entries do not quite come up to the standard of those submitted by the main prizewinners.

Envelopes containing entries should be clearly marked "*H.R.C. Railway Drawing Contest*" in the top left hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st December. The closing date for the Overseas Section is 31st March, 1934. Members' H.R.C. numbers must be quoted. The closing dates should be carefully noted, as entries received late cannot be passed on to the judges.

COMPETITION RESULTS

HOME

September "Missing Words Contest."—First: N. D. Ball (20176), Hayes. Second: B. Hull (30795), Liverpool 4. Third: C. E. Wrayford (6039), Moretonhampstead. Fourth: O. P. Nicholson (1882), Lesbury.

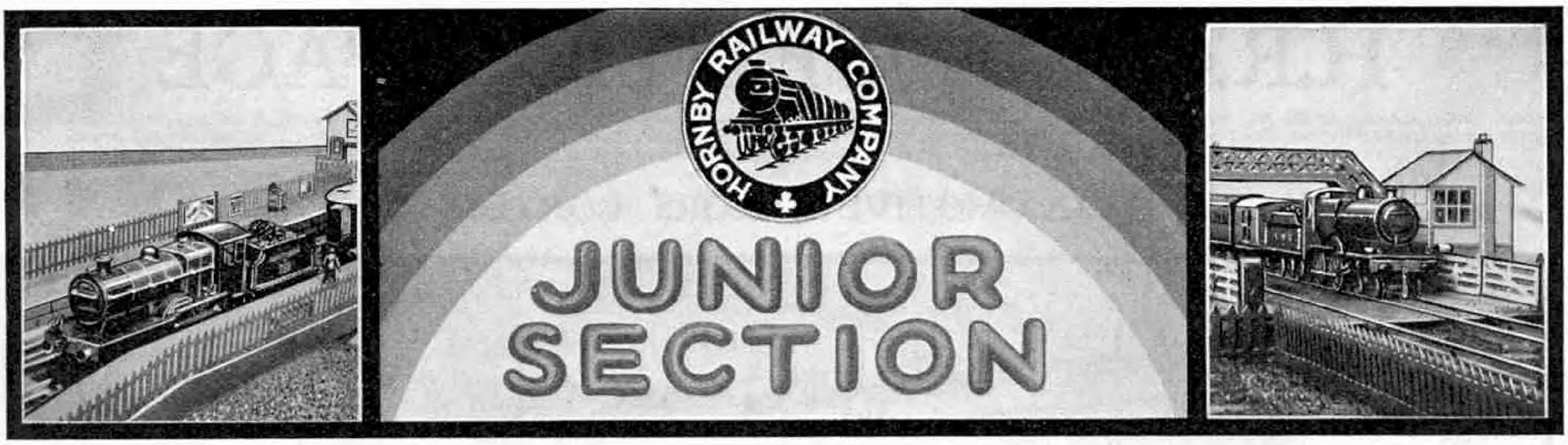
September "Essay Contest."—First: S. Hugo (2193), London, S.E.8. Second: G. Fear (34140), London, S.E.3. Third: E. R. Tobitt (1121), Castle Hedingham. Fourth: E. R. Routley (3327), Brighton.

September "Railway Photo Contest."—First: W. Robb (23368), Belfast. Second: S. Garbutt (30122), Altrincham. Third: R. Storrar (8625), Letham, Ladybank. Fourth: M. Z. Brooke (23245), Cambridge.

OVERSEAS

June "Picture Puzzle Contest."—First: R. B. McMillan (9592), Melbourne. Second: G. Hallack (17578), Capetown. Third: H. C. Key (24764), Calcutta. Fourth: D. J. White (9333), Dunedin, N.Z.

June "Railway Photo Contest."—First: J. A. Coates (23863), Canada. Second: H. van Dael (31176), Holland. Third: A. Jones (7798), Pretoria.

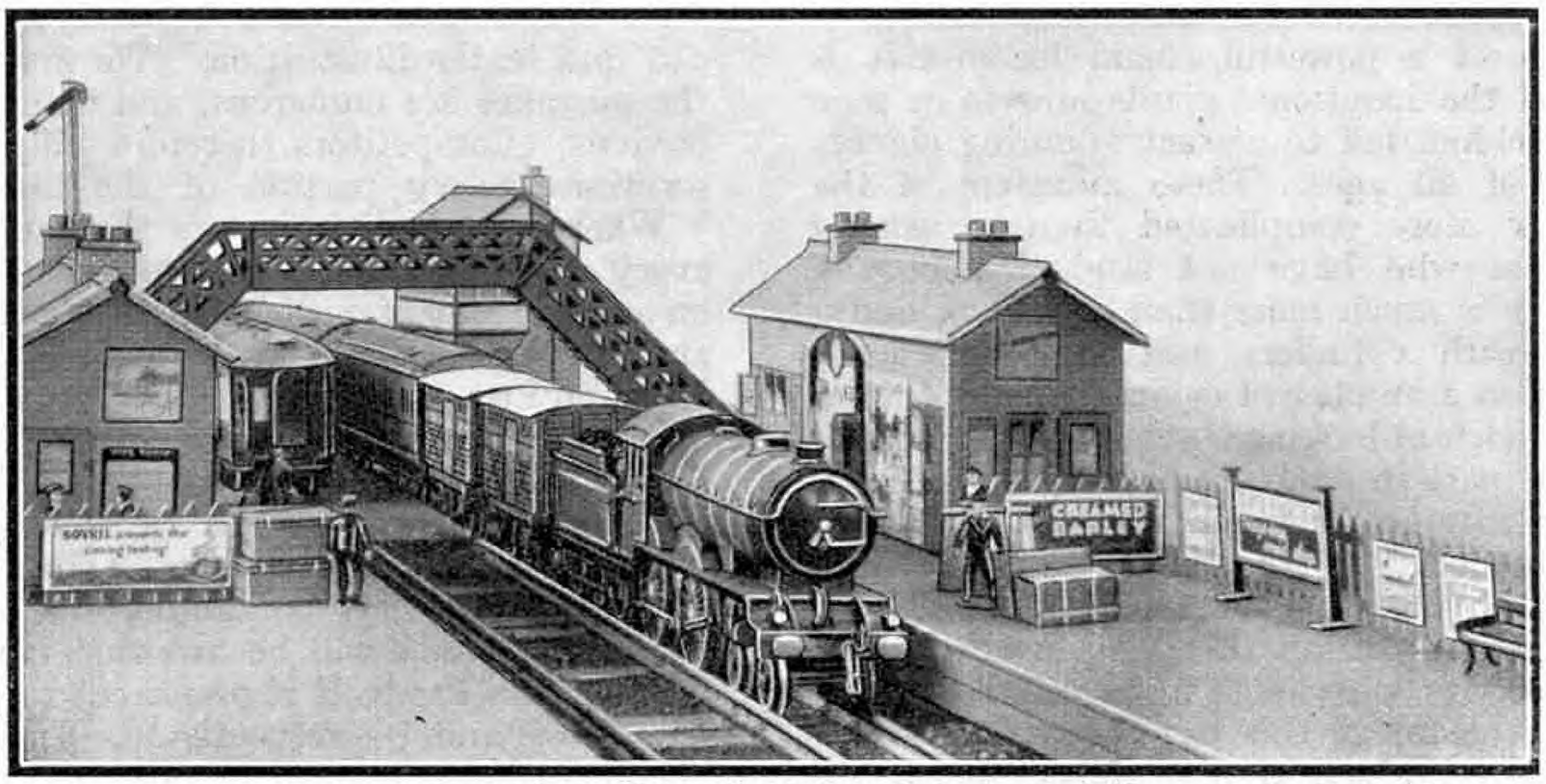


LX.—STATIONS ON HORNBY RAILWAYS

OF all the numerous accessories that can be used in connection with a miniature railway, the most necessary are stations, for they are, of course, the only places to start and stop the trains! They are extremely interesting for many reasons, chiefly on account of the variations that are possible in their arrangement, according to the conditions obtaining on the line. This month we describe various methods of arranging stations in miniature, using the components available in the Hornby Series.

Let us assume that we are examining a Hornby layout of the continuous variety, with a main terminus and two or three passing stations—the kind of layout that has often been described in these pages. We will deal with the main features of each station, and add also a few general observations. Let us commence with the terminus, whence all the main line and suburban passenger trains depart. It is desirable, but not always possible, for the station to be of sufficient size to enable the traffic to be dealt with quickly and efficiently, even when excursions or other special trains are being run. It should seldom be necessary for a train to have to wait outside the station while a platform line is being cleared to accommodate it, although this does happen both in actual and miniature practice. The platforms should be of sufficient length to accommodate the trains intended to use them, especially in the case of arrival platforms, as it looks bad for a train to come to rest with its tail some distance out from the platform end. The main arrival and departure platforms are likely to be somewhat longer than those where the local trains are accommodated, as main line stock and tender locomotives require more space than the tank engines and vehicles used for suburban services.

In a terminal station made up of Hornby material the centre section of the Railway Station No. 2 should be placed behind the buffer stops to represent the circulating area or concourse as it is often called. At right-angles to this are placed the platforms themselves, which are lengths of standard Passenger Platform. It will be noticed that coupling arrangements are provided on the face of the Station Platform to enable this to be done. This arrangement then forms what we may consider a standard terminal unit, additions being made sideways or lengthways as required, so that termini of any dimensions may be built up. Readers may exercise their ingenuity in arranging suitable entrances and road approaches. These should be as realistic as possible, but a great deal depends upon space, and the particular conditions that may happen to obtain on the spot.



A suburban station of the two-platform variety. The standard Railway Station is extended by means of sections of Passenger Platform, and the two sides are connected by a No. 1 Footbridge.

A useful accessory that may be included in a station of this description is a Platform Crane. It will prove useful in handling the parcel and similar traffic generally dealt with at passenger stations. It should be placed at the end of the platform usually used for this purpose.

Readers will remember that we have referred on several occasions to the gravity shunting of empty coaches at terminal stations, where an up gradient commences, or where a sloping carriage road is laid for the purpose. Briefly the process is that the train, having discharged its passengers, is backed out of the station on to a central shunting road that is easily accessible from all platforms. The engine is detached and run off to the turntable or water column, while the coaches are allowed to gravitate into the required platform road to form an outgoing train. On a Hornby railway this is an interesting and useful arrangement that certainly saves locomotive movements. It will be remembered that the scheme is made use of in the miniature Caledonian layout described last month.

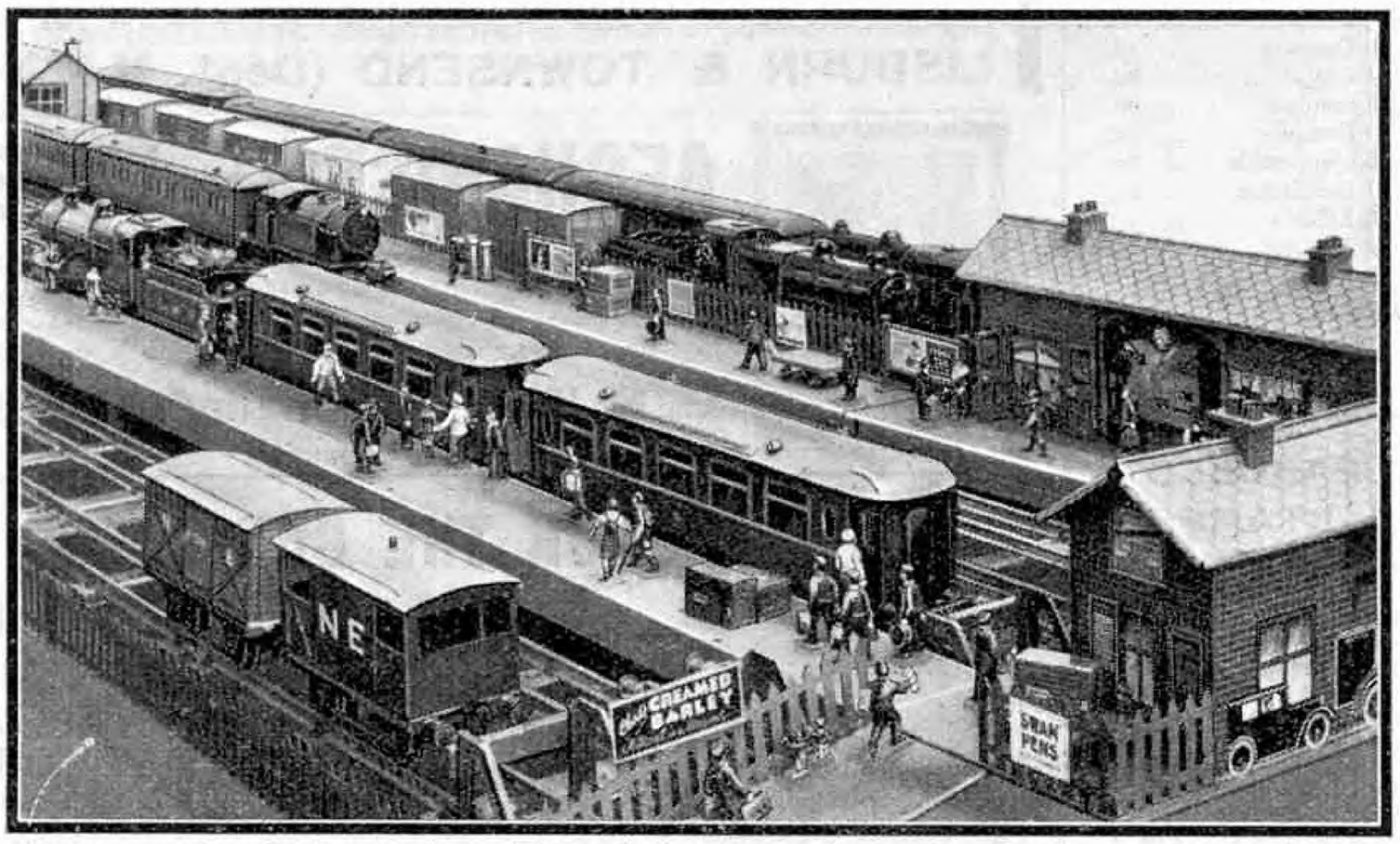
Care must be taken not to have the gradient too steep, and after a little experimenting operators will be able to find the correct slope to give their coaches sufficient momentum to come to rest in front of the buffer stops. Naturally, where this process is employed, the free running of the rolling stock must be ensured by correct lubrication. It will be an advantage also to fit all passenger coaches with Mansell wheels, as these run with far less resistance than the ordinary tin-plate type.

While dealing with the main station it will be an advantage to consider one or two points in connection with the signalling. This equipment should be as complete as possible in order to cover the various engine and train movements. A certain amount of latitude may be allowed for light engine and empty coach working, however, as it is hardly possible to provide a separate signal for every move that may be necessary.

If the various roads in the station are "track-circuited," either actually or in imagination, the various signals applying to them should be provided with a small white diamond of card attached to the signal post. These indicate to the train staff that track circuits are provided on the roads in question, and that the signalman is fully aware of the presence of any train on such lines.

A track circuit implies the provision of apparatus operated by a weak electric current in the running rails, which indicates in the signal cabin when a train is occupying the section of track in question.

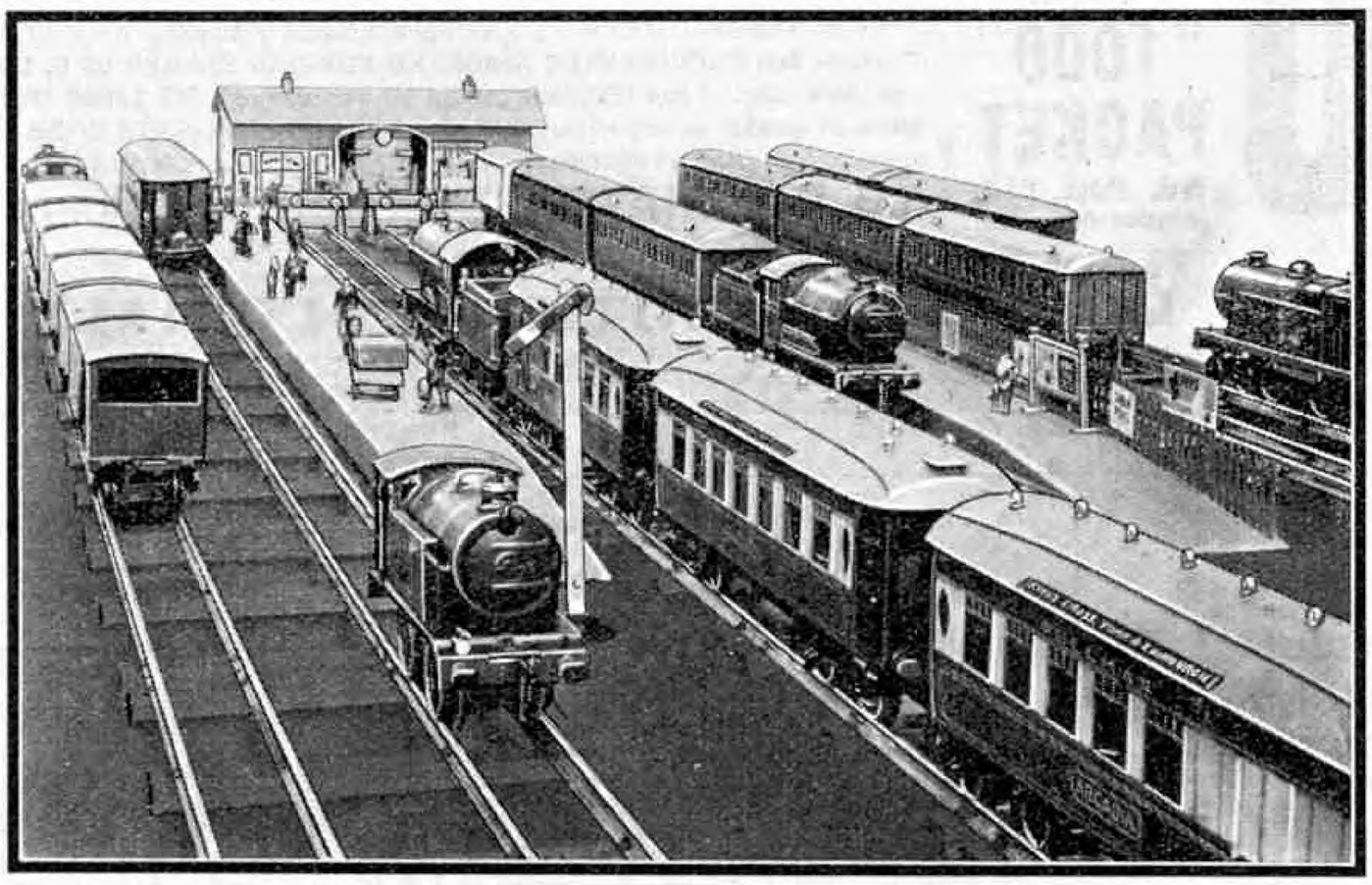
For allowing trains to enter, as far as the line is clear, a platform road that is already occupied, what are known as "calling-on" signals are used in real practice. They are sometimes small signal arms placed below the main semaphore. They may be reproduced in miniature in an interesting manner by cutting short the lower semaphore of the Double Arm Signal at the innermost point of the white V-stripe on the face of the semaphore. For this shortening process an old pair of scissors should be used if tin shears are not available. The signals thus altered may also be used to govern shunting movements from the various platforms, where perhaps a light engine or an empty train has to be run out of the station for for a short distance and then returned to another road.



A busy scene at a miniature terminus. The bustle that precedes the departure of an important express is easily reproduced at Hornby stations by suitable disposition of the various miniature figures.

Outside the station a Watchman's Hut with brazier should be placed, and if desired several Platelayer's Huts to represent the sheds and buildings used for various purposes by shunters, fogmen when on duty, and others.

Coming to the suburban stations, we find that these, if of the two-platform type, will be formed of two No. 2 Railway Stations opposite to one another. A station of this kind is shown in one of the accompanying illustrations, in which the standard Station has been lengthened by the addition of sections of Passenger Platform, complete with Paled Fencing. As an alternative, one side of the station only may be composed of lengths of Passenger Platform with Fencing. In either case of course a Footbridge should be provided to allow passengers to cross from one side to the other.



A view of a miniature terminus from the outer end of the platforms. This station, and the one shown in the upper illustration on this page, are made up of standard Hornby components, as suggested in this article.

In what we may term the "country" section of the layout the stations will be smaller, as the express trains will not require to call there except occasionally. A suitable arrangement is the use of an Island Platform between the up and down tracks. This form of station is widely used on the main line of the Great Central section of the L.N.E.R. Those who are keen on making or improving accessories may add suitable station offices, either on the platform itself, or perhaps they may place them on a road overbridge at one end of the platform. A sloping connection, after the style of the stepped approach of the Lattice Girder Footbridge, should be arranged between the road bridge and the platform. The standard Island Platform may be extended with lengths of Passenger Platform, and completed with ramps at each end.

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20 Siam ...	4d.	10 Chili ...	4d.
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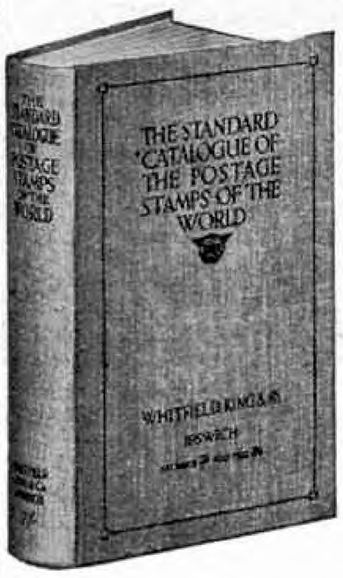
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Stamp Collecting

SOME GENERAL HINTS ON FORMING A COLLECTION

AT this season many thousands of our readers will be forming their first stamp collection, and a few general hints to guide them in their early efforts will be helpful.

We are not concerned here with the equipment of the collector so much as with the stamps themselves. We dealt with general questions of equipment in a series of articles that appeared in the "*M.M.*" earlier this year. Copies of the numbers containing those articles can be had from the Publishing Department, price 8d. each, including postage. For the present we are going to assume that the collector has received a gift of stamps and has secured an album and a packet of good quality stamp hinges, and is now concerned with adding to this nucleus.

If he is in the happy position of having relatives and friends in offices that conduct a large world-wide correspondence he need never lack for specimens of current issues, but rarely will the quantity of stamps secured in this way be sufficient to maintain his enthusiasm. He will find it necessary to purchase additional stamps, either in the form of a packet containing anything from perhaps a dozen up to 10,000 stamps covering various countries, packets containing only the stamps of one particular country, sometimes known as "long" sets, or simply sets of an individual issue from one country.

In the first place the collector would be well advised to buy the largest general packet that he can afford. A collection of 1,000 different stamps from various countries may be obtained for about 5/–, and forms an excellent start to a general collection. The importance of buying the largest general packet that can be afforded cannot be emphasised too strongly.

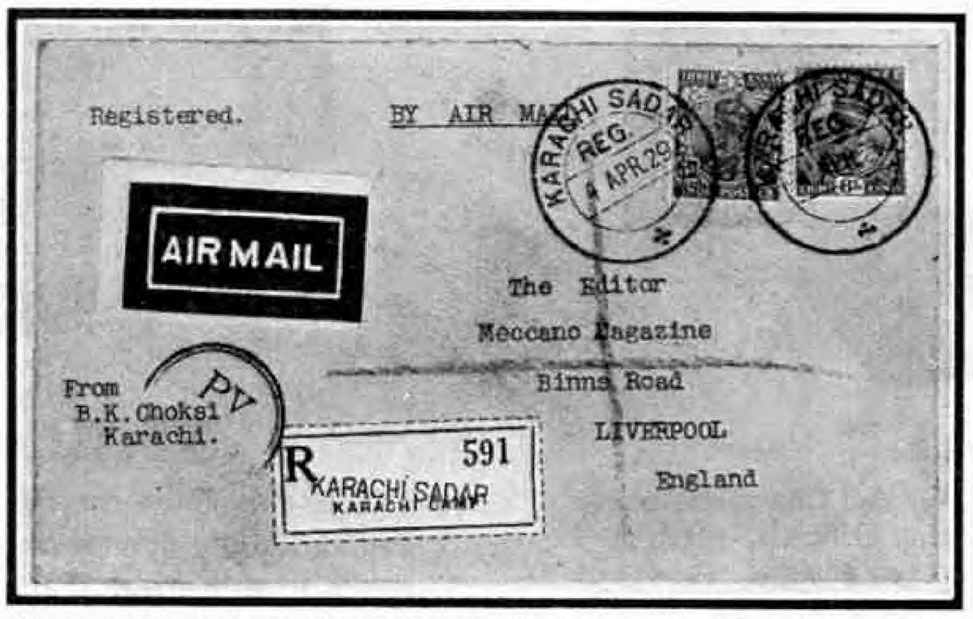
From this stage the young collector should turn his attention to the long sets offered by reputable dealers. These long sets are, in effect, small general collections of the individual countries concerned, and although here and there they may be found to contain duplicates of stamps already possessed, the difficulty is not likely to be encountered in anything like so troublesome a degree as in the purchase of further general packets. Obviously if the collector has only a few Italian stamps, for example, and purchases a long set—the new Whitfield King list offers 50 for 6d. or 200 for 6/6—the appearance of one or two stamps duplicating specimens already in the collection is of no importance, because the cost of the long set is vastly lower than would be involved if the stamps were purchased item by item to avoid duplication.



An example of a perfectly centred unused stamp.

Long sets usually comprise oddments of sets of individual issues, and contain many small gaps that the collector will desire to fill at the first opportunity. The "want list" and "Approval sheet" systems come to his aid at this point.

In the "want list" system the collector will send to a stamp dealer a list of stamps that he desires to purchase. The dealer's catalogue number should be quoted if he issues a catalogue, or if not, the Gibbons' or Whitfield King catalogue numbers will be recognised. In reply, the dealer will indicate which of the stamps he can supply, and in most cases will forward the actual stamps for inspection and purchase if approved. The "approval sheet" system works in a slightly different way. The collector asks the dealer to submit sheets of stamps of countries that interest him, and purchases any stamps on those sheets that he requires, returning the unwanted stamps together with cash for the stamps purchased.



An example of stamps best left on their cover. An air mail cover from the first Karachi-London air mail flight.

Many stamp dealers, by the way, will not send approval sheets to boys at school unless the permission of the Headmaster, or, if the boy lives at home, of his parent, has been given; or in the absence of that permission, only if the collector has first made a small deposit of cash against the value of the sheets. The dealer who insists upon the observance of these precautions should not be dubbed a "doubting Thomas," but regarded as a straightforward business man.

It should be borne in mind that if a collection of approval sheets should be lost while in the possession of a schoolboy, or if a boy should be dishonest and refuse to return the sheets, the dealer has absolutely no remedy. Sheets lost in this manner add seriously to the dealer's trading expenses, and he is obliged to charge more for his remaining stamps in order to recoup his loss. It follows, therefore, that a dealer who takes reasonable precautions to avoid loss is able to offer better value than those of his competitors who take unnecessary risks.



An interesting cutting. The postmark shows that the stamp was used on the first day of issue. Such specimens should be left on their covers.

So far we have considered only means of acquiring stamps, but it is even more important to consider the quality of the stamps acquired. Every young collector should set himself a definite standard of quality for the stamps to be included in his collection. The condition of a stamp, after consideration of its rarity, determines its value. The perfect unused stamp obviously is one that still possesses the bloom and perfect gum with which it left the printer. It must be perfectly centred, that is with equal margins all round; and if perforated it must have all the perforation teeth intact. In a used specimen the same considerations of centring and perforation arise, and in addition the postmark must be so light as to leave unobscured the important parts of the design.

In no circumstances should damaged stamps or heavily postmarked specimens of common issues be included, for they ruin the appearance of the collection, and depreciate heavily its value as a whole. Between these and the standards of perfection there is a wide gap, however, and somewhere in that gap is the point of the standard that the young collector must fix for himself.

No stamp should be mounted in the collection until every scrap of paper is removed from its back. This operation presents problems to most new collectors, but it is not really difficult if simple precautions are observed.

The system we ourselves use is to lay the stamps face upward on a wad of blotting paper lying on a plate, until the damp has penetrated the paper backing sufficiently to enable it to be detached, but before the moisture has penetrated the back of the stamp itself and affected the colours or the postmark on the face.



This specimen is not well centred. The margin on the left is much wider than that on the right.

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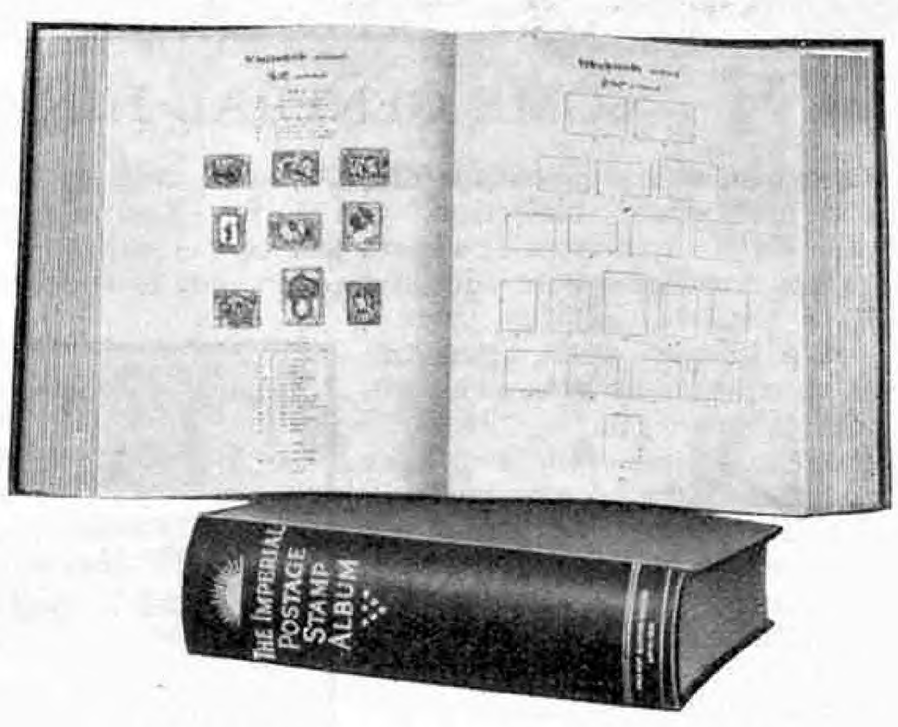
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Stamp Gossip

and Notes on New Issues



New Printers for British Stamps

The new contract for the printing of Britain's postage and fiscal stamps has been placed with Harrison and Sons Ltd., of London, and for a period of some years this firm will be responsible for all Britain's stamp requirements.



The new printers have issued a brief memorandum of interesting facts relating to the contract. This states that all denominations up to the shilling value are to be printed by the photogravure process. About 230 tons of paper and 110 tons of gum are required to produce a year's supply, a total of seven thousand million stamps of a face value of about £38,000,000. The gum used is pure arabic from the Sudan. The ink has to fulfil many qualifications. It must be fast to light, insoluble in water, free from lead and all other poisonous materials, and proof against the removal of cancellation ink without destroying the colour on the stamp.

Next year is the centenary year of the adhesive postage stamp. It was in 1834 that the first postage stamp was produced experimentally by James Chalmers of Dundee. Perkins, Bacon and Co. Ltd., who developed the steel plate recess method, were given the stamp contract in 1840, and they held it for 40 years. Thomas De La Rue and Co. Ltd., succeeded them in 1880 and held the contract until 1910, when Harrison and Sons Ltd., secured it. They ceded it to Waterlow and Sons Ltd., in 1924.

It is no secret that the British postage stamp contract does not yield a big profit to the printer, but the holding of it confers a distinction. More profits follow from foreign stamp contracts awarded by other governments that follow the lead of the British Government in their selection of a printer to be entrusted with the responsible work of producing the stamp issues.

* * * *

To stimulate public interest in the National Recovery Act introduced by President Roosevelt to help the revival of trade in the United States, a special stamp, which we illustrate here, has been issued. The design is symbolic of the determination of all classes to hasten the improvement of conditions. It shows an agricultural worker, an artisan, a professional man and a girl office worker marching forward shoulder to shoulder in, as the inscription at the foot puts it, "A common determination."



A Junior's "Find"

The following amusing story, a winner in a recent Stamp Anecdote Competition promoted by "*Gibbons' Stamp Monthly*," will revive memories of great hopes aroused in a similar manner in the breasts of many of our readers during their early stamp collecting days.

"The stamp which brings to my mind the most vivid recollection is the one cent maple-leaf Queen Victoria stamp of Canada. When I first started collecting stamps (in 1926) I read a book connected with the hobby. In it, I read that only two stamps had been issued bearing the portrait of Queen Alexandra. I, at that time, did not know that this meant two different specimens, but I confused it with the total issue sold to the public. A few days later I bought a penny packet of stamps and, among them, I found a maple-leaf Queen Victoria Canadian one. This was the first stamp with a Queen's head I ever saw, so I jumped to the conclusion that this was one of the 'only two specimens of a stamp bearing Alexandra's head.'

"Without asking anybody's advice about the matter, I went to the Strand to sell it. On the way I bought a *Boy's Own Paper*, and in the stamp column I saw that the one known specimen of a British Guiana stamp was worth £7,000. Therefore, I thought, my stamp was worth £3,500. I entered Messrs. Blank's shop and announced I had a valuable stamp for sale, and with a flourish I pulled my 'find' from my pocket. The man looked at the stamp, at me, and led me to the door by the ear."



I.F.S. Holy Year Issue

In our last issue we commented that the Holy Year stamp, illustrated here, is easily the best I.F.S. commemorative yet issued. That view is confirmed by the remarkable sale that it has achieved. More than three million of the stamps were distributed throughout the country on the Saturday preceding the first day of issue, but 40 Dublin post offices were sold out within an hour of opening. It would seem likely that the sales of this issue will easily exceed those for any previous I.F.S. commemorative.

* * * * *

We illustrate this month the 2 lire express stamp from the recent Vatican City series. It shows a bird's eye view of the Vatican State.

Latvian Air Charity Issues

The stamp collector who is also an aeronautical enthusiast has found considerable interest in Latvia's recent series of air charity stamps. They have provided a splendid pictorial review of aeronautical development.

The fourth—and last—issue of the series has now appeared, and contains four values, 8, 12, 30 and 40 sant. The designs are excellent, the lowest value, illustrated here, showing the remarkable American high speed monoplane "Gee Bee," that created a speed record of 294.2 m.p.h. for land machines in 1932. The other designs are:—12s., a British Schneider Trophy racing plane; 30s., "Graf Zeppelin" flying over the sea front at Riga; 40s., the Dornier Do.X.

A Peace Propaganda Stamp

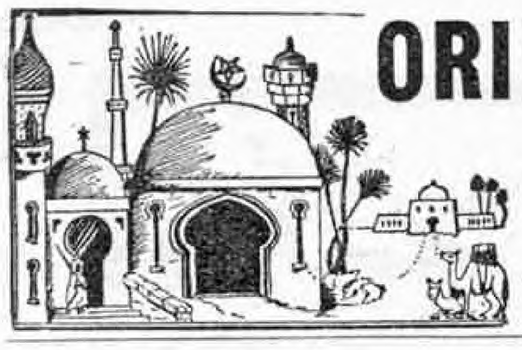
Every right-minded person is so wholeheartedly in favour of anything that may promote honourable peace that the efforts of the World Peace Union to induce every nation to issue special "Peace" propaganda stamps will be watched with great interest. Several countries are reported to be in sympathy with the idea, and Holland, with its usual enthusiasm for such causes, has already adopted it. The Dutch 12½c. stamp illustrated here is thus the first of the "Peace" issues to appear. The colour is blue and the design most attractive indeed. The issue has already achieved great popularity among collectors.



A Useful Price List

Messrs. Whitfield King and Company's 1934 price list reached our desk just as we finished dictating this month's stamp article. This year its 150 pages list more than 4,000 different long and short sets and packets, and the requirements of every young collector, particularly those in the early stages of collection-building, can be met. Messrs. Whitfield King and Company, Ipswich, will send a copy of this list, free of charge, to any "*M.M.*" reader who applies.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.



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A fine packet of all different Stamps containing **Manchukuo,** 1932 ½ fen pictorial, **French Indo China Air Mail,** unused, **Eritrea,** 1930 2c., large pictorial **Somali Coast, Tunis** 1933, new issue, **Turkey** pictorial, **Brazil** pictorial, **Nigeria, Portugal, Ceylon,** etc., free to all asking to see my famous Approval Sheets and enclosing **2d. for postage.** (**Abroad 6d. P.O.**)
Albums, **1/4, 2/6, 5/–** and upwards.
S. HAMMOND, CHESHAM FIELDS, BURY, LANCS.

FREE BOYS!! Wear this splendid Stamp Badge. It's FREE



Just send 2d. to cover postage and you will be enrolled as a Junior Member of **"THE EMPIRE STAMP LEAGUE,"** and will receive the splendid League Badge with design as illustrated in the League Colours—Red and Blue. **YOU'LL BE PROUD TO WEAR THIS BADGE! WRITE NOW**—the Badge is waiting for you. Request Approvals.
VICTOR BANCROFT,
Empire Stamp League (M.M.), Matlock, Eng.
If **extra 2d.** be sent (4d. in all), a splendid Magnifying Glass in folding metal frame will be included as well as the badge.

"AMAZING FREE OFFER"
DO NOT DELAY, SEND AT ONCE FOR THIS AMAZING PACKET. IT IS ABSOLUTELY FREE TO GENUINE APPROVAL APPLICANTS.
PUCKA STAMP CO., 27, Normandy Avenue, BARNET.

BOYS, do not miss this amazing offer which consists of the following **50 all diff. scarce** stamps, and every one is a **genuine postal copy**:—Set of **9 India** (including **5 'Service'**), set of **7 Japan** (cat. 8d.), set of **6 Africa** (large Pictorials, etc.), **3 scarce Nigeria** (including **SCARCE 3d. (CAT. 8d.), 3 Irish, 2 Obsolete Gold Coast, 4 Canadian, N.Z.** (½d., 1d., 2d.), **2 Kenya** high values, **2 U.S.A.** (Bi-centenary), **France** (Exhibition issue), **Obsolete Malta, Hong Kong, Cape of Good Hope, Old Victoria, South Australia, Sierra Leone, scarce Natal,** and a **Hungary Official** (Cat. 4d.). SEND 2d. POSTAGE.

For further Stamp Advertisements see page 1055

Competition Corner

ADVERTISEMENT "JIG-SAW" CONTEST

There are few more exciting occupations at this time of the year than searching through the advertisement pages of the *"M.M."* for suitable Christmas presents. This process is a necessary preliminary to a visit to the shops to investigate the articles themselves.

This issue of the *"M.M."* contains many more advertisements than have appeared in any previous issue, and to celebrate the occasion we have decided to build around the advertisements an interesting competition in which every reader, no matter what his age may be, can take part.

The curious illustration that appears on this page consists of 47 fragments that have been cut from the advertisements appearing in this month's *"M.M."*, and readers are invited to discover the names of the advertisers from whose advertisements they have been taken. Some of the fragments are fairly easy to trace, but others will be found difficult, and we believe they will tax our readers' sharp eyes and ingenuity to a considerable extent. It should be noted that when an advertiser has more than one advertisement care must be taken to state the number of the page from which the cutting is taken.



Four prizes of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively, to be chosen by the winners from our current catalogues, are offered to the senders of the four most accurate solutions in order of merit. In addition there will be a number of consolation prizes. A similar set of prizes will be reserved for entries from Overseas readers.

In response to a number of enquiries we take this opportunity of stating that by "Meccano products" we mean all goods produced in the Meccano Factory. This means that in addition to Meccano Outfits and Parts, and Hornby Train Sets and components, there are now available for prizes Meccano "X" Series Outfits, Hornby Speed Boats, Meccano Aeroplane Constructor Outfits, Meccano Motor Car Constructor Outfits, Kemex Chemical Outfits, and Elektron Electrical Outfits.

Entries for this competition must be addressed *"Jig-Saw Contest, Meccano Magazine, Binns Road, Liverpool 13."* Home entries must reach this office not later than 30th December; and Overseas entries not later than 31st March, 1934.

A Christmas Drawing Contest

Among the most popular of our many Drawing Contests have been those in which readers were required to depict their ideas of future engineering developments, such as the aeroplanes and locomotives of 50 or 100 years hence. It occurred to us that a combination of this type of contest with something closely connected with the cheery spirit of Christmas time would provide our artist readers with an interesting and amusing competition. With this end in view we have chosen as the subject of this month's Drawing Contest *"Santa Claus Delivering His Gifts In The Year 2033."* A hundred years hence Santa Claus may reasonably be expected to have finally abandoned his reindeer-drawn sleigh and adopted some high-speed form of transport in keeping with the times. How will he travel? That is what we want our readers to visualise, and to depict in pencil or in colour as they prefer.

Entries will be divided into two sections, A for readers aged 16 and over, and B for those under 16. Three prizes consisting of Meccano products to the value of 21/–, 15/– and 10/6 respectively will be awarded in each section, and in addition there will be a number of consolation prizes. A separate set of prizes to the same values will be awarded to Overseas readers.

Entries must be addressed *"Christmas Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13,"* and must arrive not later than 30th December. Overseas closing date, 31st March.

Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose. Overseas readers may send International reply coupons.

COMPETITION RESULTS

HOME

Advertisement Silhouettes.—A splendid number of entries was received for this competition, and many small points of difference had to be considered before the prizes were finally allocated. The full solution will be published immediately the Overseas section closes, and in the meantime here is the list of winners in the Home Section:—1. R. Howitt (Kirby Muxloe); 2. R. M. Price (Birmingham); 3. R. C. Read (Portsmouth); 4. C. Goodman (Horley). Consolation Prizes: B. Abernethy (Motherwell); W. Bailey (Hucknell); P. L. Edwards (Birmingham); D. Fosten (Battersea, S.W.); D. Godfrey (Upper Norwood, S.E.19); E. Knott (Stockport); T. N. Rogerson (Dublin); P. J. MacIntyre (Edinburgh); R. W. Scott (London, W.14); P. R. Miller (Battersea, S.W.11); P. N. Cooper (Leicester); R. S. W. Frodsham (Nottingham); P. C. Wrightson (Wallasey); A. T. Elliot (Brighton); S. T. Grant (Glasgow).

OVERSEAS

July Photo Contest.—First Prizes: Section A, C. J. McCain (Sydney, N.S.W.); Section B, T. Martin (Johannesburg). Second Prizes: Section A, A. A. Boult (Auckland, N.Z.); Section B, J. R. Roberts (Sydney, N.S.W.).



A NARROW ESCAPE

"Mary, have you seen my cap?"

"Sure, Pat, it's on your head."

"So it is. If you hadn't told me I'd have gone to work without it."

* * * *

Two little girls were quarrelling over which was the taller. "I'm taller than you," said the first, "because I can look over those boards."

"That's nothing," said her companion, "I have to bend down to look over!"

* * * *

Explorer: "Yes, isn't it strange that when people get frozen they rub their limbs with snow until circulation is restored?"

Old Lady: "But what do they do with the poor people in the summer, when there is no snow?"

* * * *

Nervous Passenger: "Don't drive so quickly round the corners. It makes me frightened."

Chauffeur: "You don't want to get scared. Do what I do—shut your eyes when we come to corners."

* * * *

"What rank did you hold?" the old lady asked the supposed one-time sailor.

"Ship's optician, lady."

"Ship's optician! I never knew there was such a rank in the Navy. What did your duties consist of?"

"Scraping the eyes of the ship's potatoes!"

* * * *

Mrs. Young had insisted on packing innumerable frocks, coats and hats, and she and Mr. Young arrived at the station loaded with luggage.

"I wish," said the husband thoughtfully, "that we'd brought the piano."

"You needn't try to be sarcastic," came the frigid reply.

"I'm not trying to be," he explained sadly. "I left the tickets on it."

* * * *

RAPID FIRE

An old negro woman walked into an insurance office and said she wanted some fire insurance. The clerk asked her what she wanted to insure.

"Mah husband," she said.

"Then you don't want fire insurance," said the clerk. "What you want is life insurance."

"No, ah don't," explained the woman. "Ah wants fire insurance. Mah husband has been fired fo' times in the last two weeks."

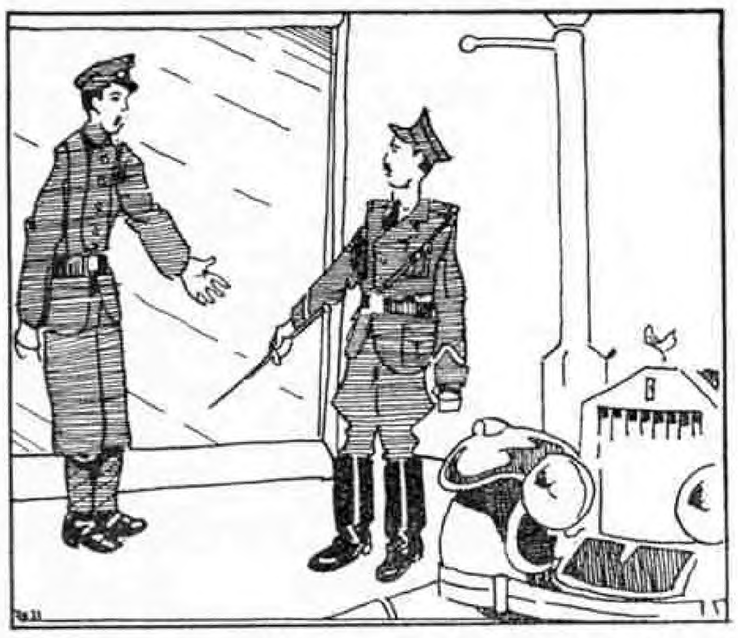
* * * *

"Watch the little dickey bird," said the photographer.

The modern child was not impressed. "Just pay attention to your exposure or you will ruin the plate," he sternly admonished.

* * * *

NO COMPARISON



Officer (to recruit who has passed him without saluting): "Don't you see my uniform?"

Recruit: "Yes, very smart, isn't it? And look at the rotten thing they've given me!"

A LONG JOB

The new maid had been entrusted with the preparation of dinner.

"What about the soup?" she was asked when she appeared with the fish.

"You'll have to have that to-morrow, m'm," was the reply. "You ordered split peas, and it's taken me hours to prepare just a few."

* * * *

A club of eccentric young men had a rule that on one evening a week any member who asked a question that he was unable to answer himself should pay a fine of 10/-. One evening Tomkinson asked: "Why doesn't a ground squirrel leave any dirt round the top of his hole when he digs it?"

After some deliberation he was called upon to answer his own question.

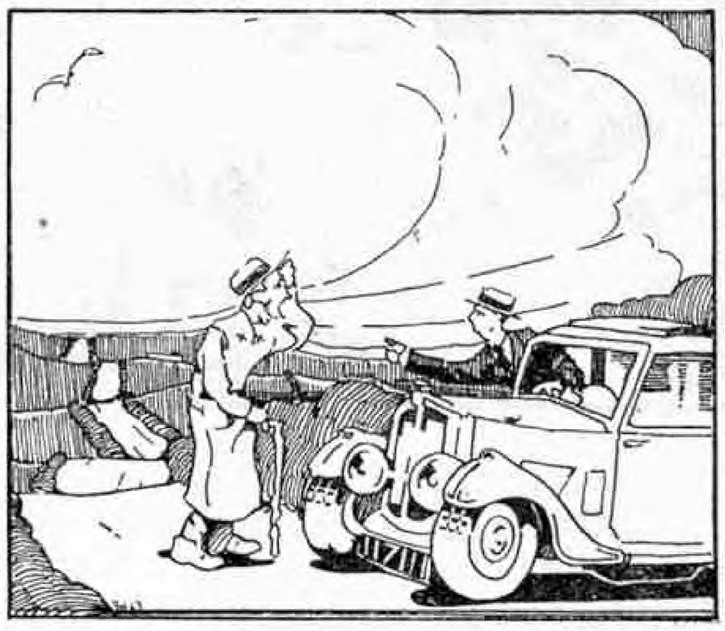
"That's easy," he said. "The squirrel starts at the bottom and digs up."

"All very nice," suggested a member, "but how does it get to the bottom?"

"That's your question," answered Tomkinson.

* * * *

A FIXTURE



Motorist: "Where does this road go?"

Yokel (after prolonged thought): "Oi don't think it goes anywhere, sir. It's always here first thing in the morning."

* * * *

Little Harry, who was just learning to count, heard the clock strike.

"Mummy," he said excitedly, "the clock has just struck one three times."

* * * *

The park orator was warming to his subject.

"Yes, my friends," he said. "We live in a wonderful era; this Age of Steel."

"You're right," excitedly exclaimed a listener. "Somebody's taken my watch."

* * * *

They were very particular about the class of tenants in the new block of suburban super flats.

"We are most anxious that our flats shall be quiet," said the agent. "Have you any noisy children, a wireless or radiogram, musical instruments, and do you keep a dog or cat?"

"No," murmured the prospective tenant; "but I am afraid my fountain pen scratches a little sometimes."

* * * *

A mechanic was studying a text book with a view to improving his knowledge. One of the problems read: "At a point so situated on the surface of the material as to be equidistant from the extreme edge in all directions, produce by means of a suitable cutting device of correct form and dimensions, a circular aperture, having a uniform diameter of .5 inches."

"Blow me, Bill," he called to his pal, "what's all this mean?"

"Why, yer igneramus, shove a 'arf-inch drill through the middle."

WHEN TIME IS NOT MONEY

"Isn't it about time you paid for that wireless set I let you have?"

"It isn't a question of time, old man, but of money."

* * * *

"I can't sleep these cold nights. What can I do about it?"

"Just lie on the edge of the bed, and you are sure to drop off."

* * * *

The pickpocket was caught in the act of taking a watch.

"Excuse me," said his victim, "but I have no time to spare."

* * * *

A recruit in the Army got tired of being chaffed about his impediment of speech, which was particularly awkward as his number was 666. One day, on parade, the sergeant called out: "Private Thompson, what is your number?"

"Half a dozen, half a dozen, half a dozen," replied Private Thompson. "You thought I'd say thicx, thicx, thicx!"

* * * *

"And are you really satisfied with walking about the country begging?" asked the housewife.

"No, ma'am," replied the tramp. "I'll soon have enough money saved up to buy a second-hand car."

* * * *

Husband (relaying carpet): "I shall lose my temper with this confounded carpet in a minute!"

Wife: "That's right dear, do. Then take a stick and give it a jolly good hiding out on the lawn."

* * * *

"You gave that cloakroom attendant a big tip, old boy."

"Well, he gave me a good coat."

* * * *

A Swedish farmer who wanted to make his permanent home in America appeared for his naturalisation papers.

"Are you satisfied with the general conditions of this country, Mr. Olson?" he was asked.

"Yah, sure," answered Olson.

"And does this Government of ours suit you?"

"Well, yah, mostly," stammered Olson, "only Ay lak to see more rain."

* * * *

"And how are you getting on, Mrs. Ferguson?"

"No so well, Mrs. Crown. My poor husband has had a parallel stroke and we are having a time making ends meet."

* * * *

"My car runs a little way and then stops."

"A spurt model, eh?"

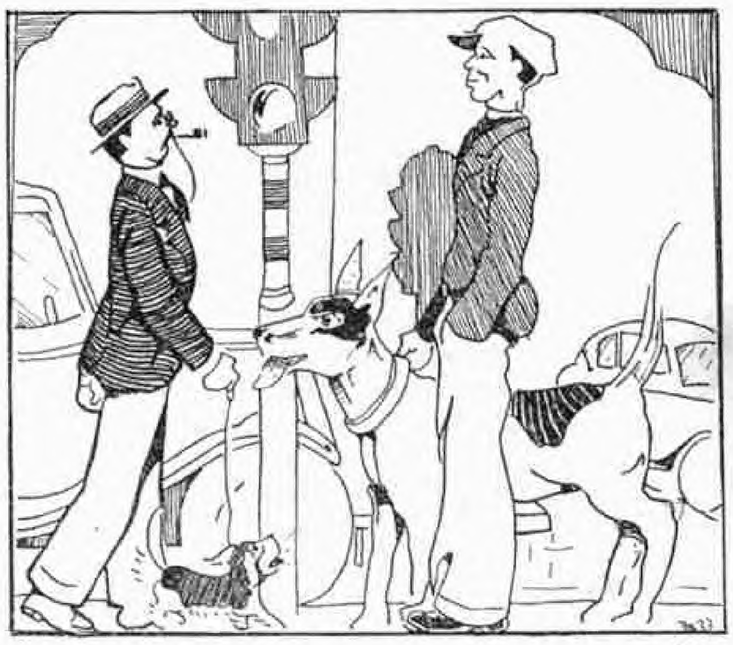
* * * *

"Give an example of period furniture."

"Well, an electric chair, because it ends a sentence."

* * * *

A GALE WARNING



"Keep tight hold of your dog, sir. I think mine's going to sneeze!"

TESTING THE STRENGTH OF A NEW MODEL



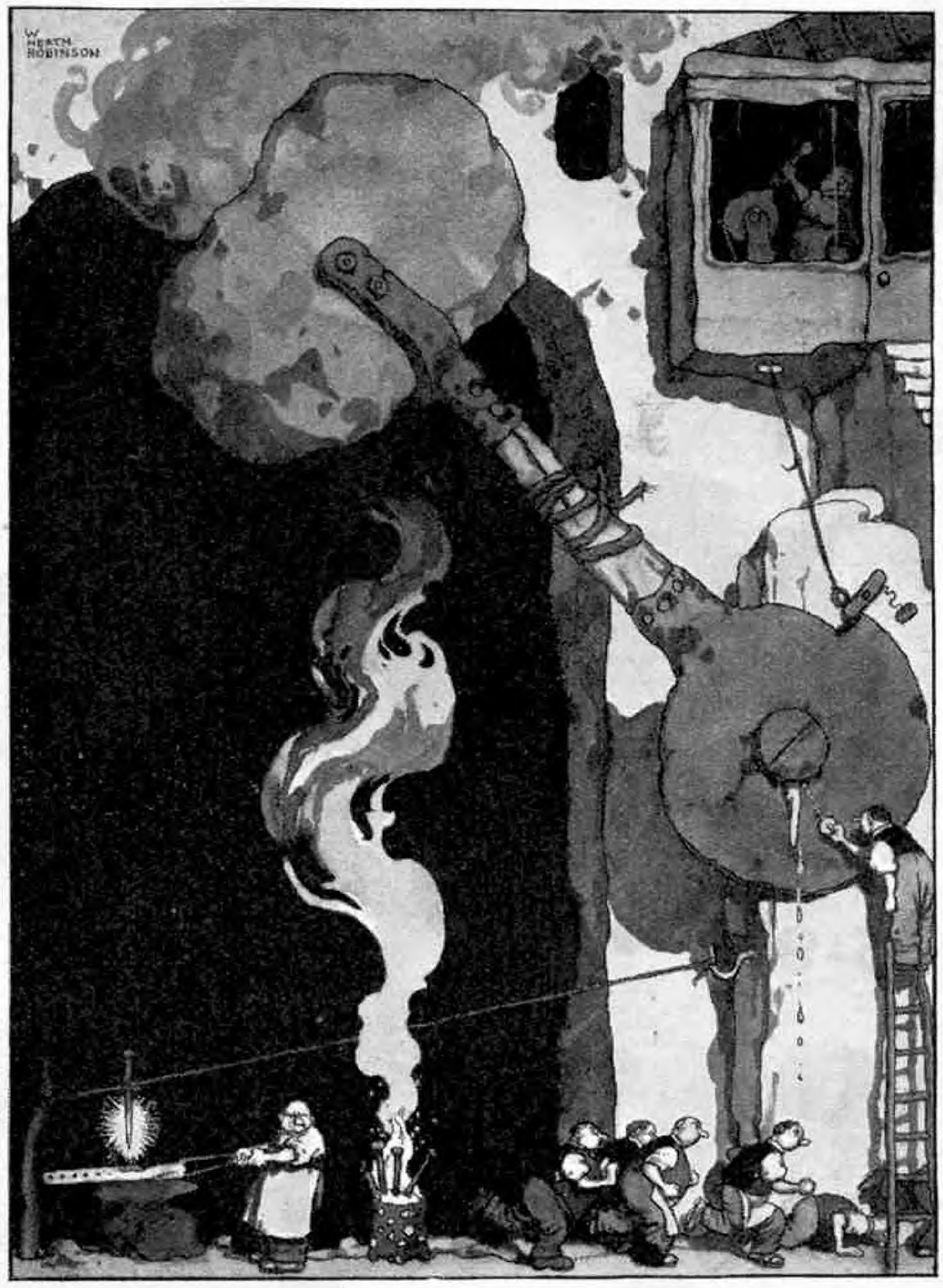
TESTING A MECCANO PERAMBULATOR



TESTING A MECCANO ROCKING CHAIR



THE MECCANO HOLER AT WORK



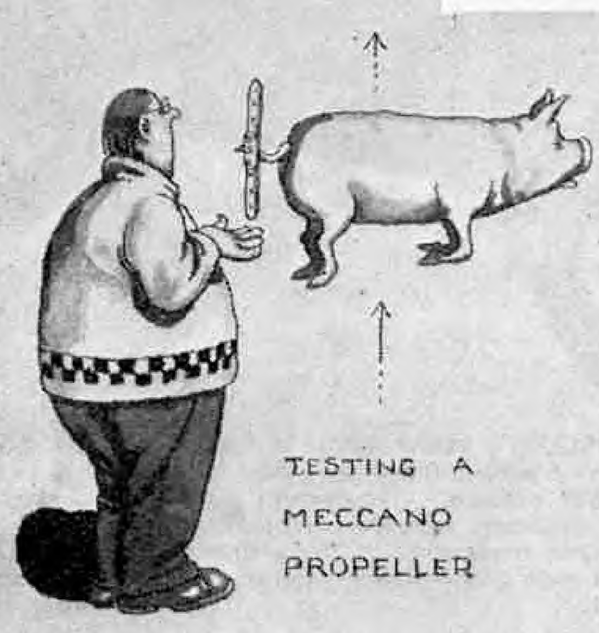


THE ARDUOUS WORK OF THE MECCANO HOLE COUNTER

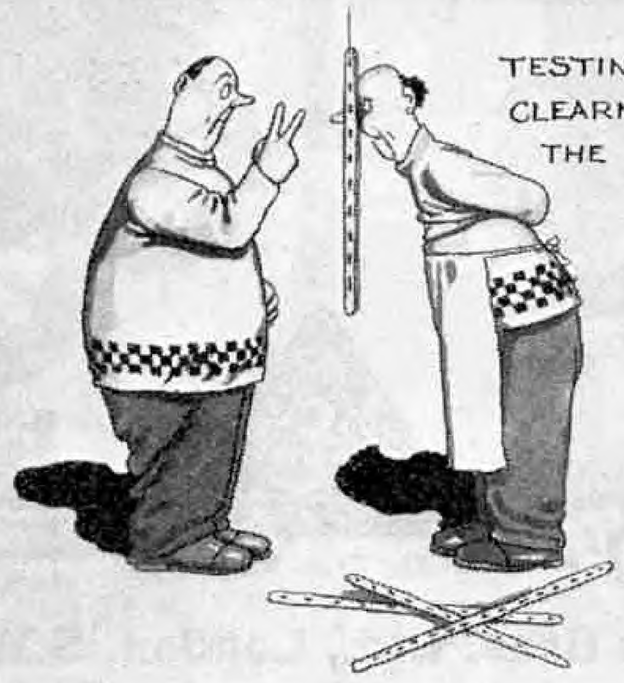
MECCANO TRUCK TESTING



TESTING A MECCANO PROPELLER

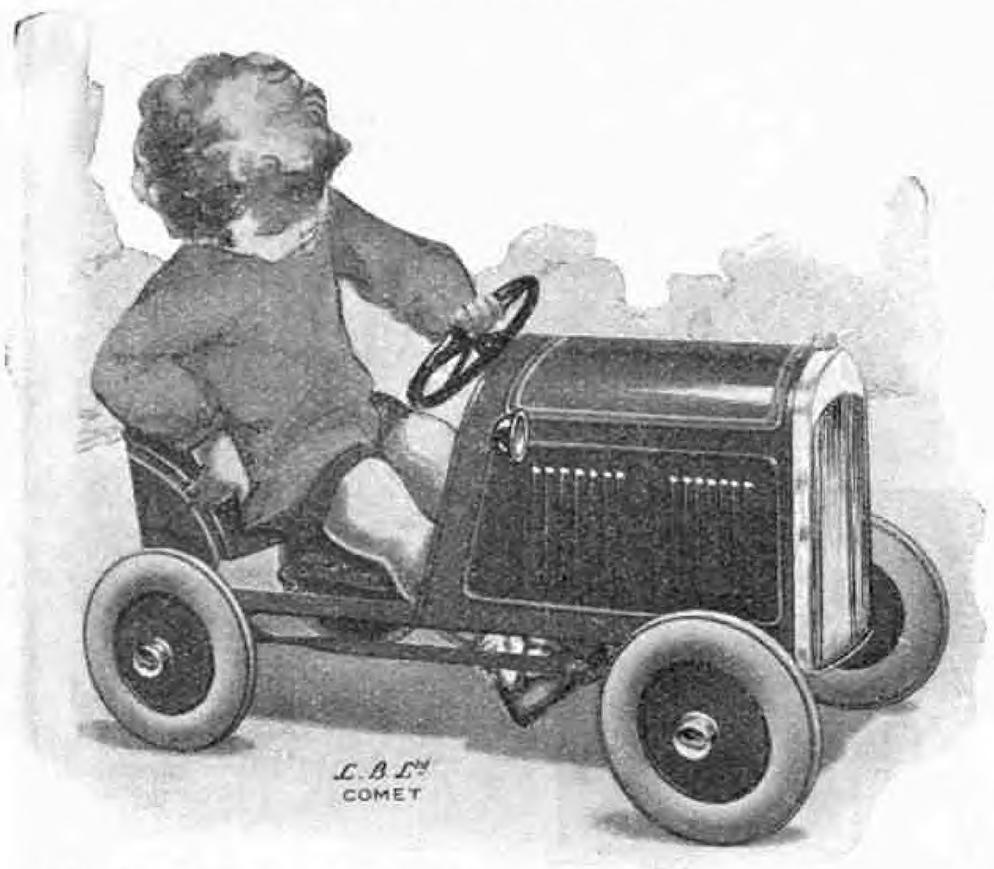


TESTING THE CLEARNESS OF THE HOLES



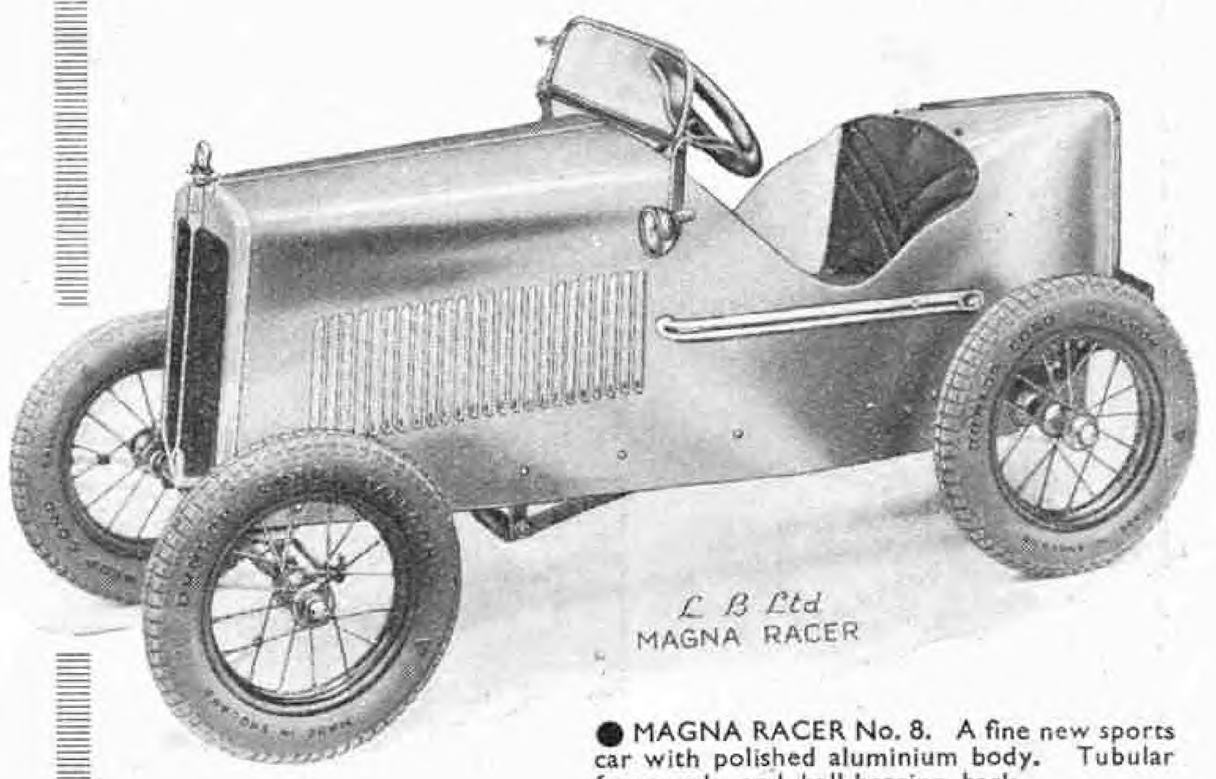
Mr. Heath Robinson's idea of how Meccano is made and tested.

A Selection of TRI-ANG Popular Cars



● COMET. Moulded steel body with plated radiator. Large balloon wheels with rubber tyres. Double crank drive with rubber pedals. Two dummy lamps and petrol and oil cans. Finished in red. 31 ins. long. Wonderful value. Price **17/11**

These cars are obtainable from all good Stores and Toy Shops



● MAGNA RACER No. 8. A fine new sports car with polished aluminium body. Tubular front axle and ball-bearing back axle. Seat and back upholstered. Tubular windscreen and direction indicator. Length 52 ins. Price **92/6**



● MAGNA No. 8. A fine model of a modern Sports Car. Low built body gives racy appearance. Very easy running. Double crank drive with ball-bearing back axle and tubular front axle. Strong band brake. Tubular windscreen, direction indicator, four sports type mudguards, side-opening door, 5 lamps. Fully upholstered back and seat. Dummy hood. 2¼ in. Dunlop pneumatic tyres, tangent spoke wheels with chromium-plated rims. All lamps, etc., chromium-plated. Length 57 ins. Price **£5-9-6**

Extra for spare wheel and tyre, **10/-**

MAGNA RACER No. 6. Similar to No. 8 but with tangent spoke wheels and 1⅛" sponge rubber tyres. Price **65/-**

MAGNA No. 6. (not illustrated). Similar car to Magna No. 8, but with 1¼" white auto tread tyres on tangent spoke wheels, nickel plated fittings. Price **75/-**

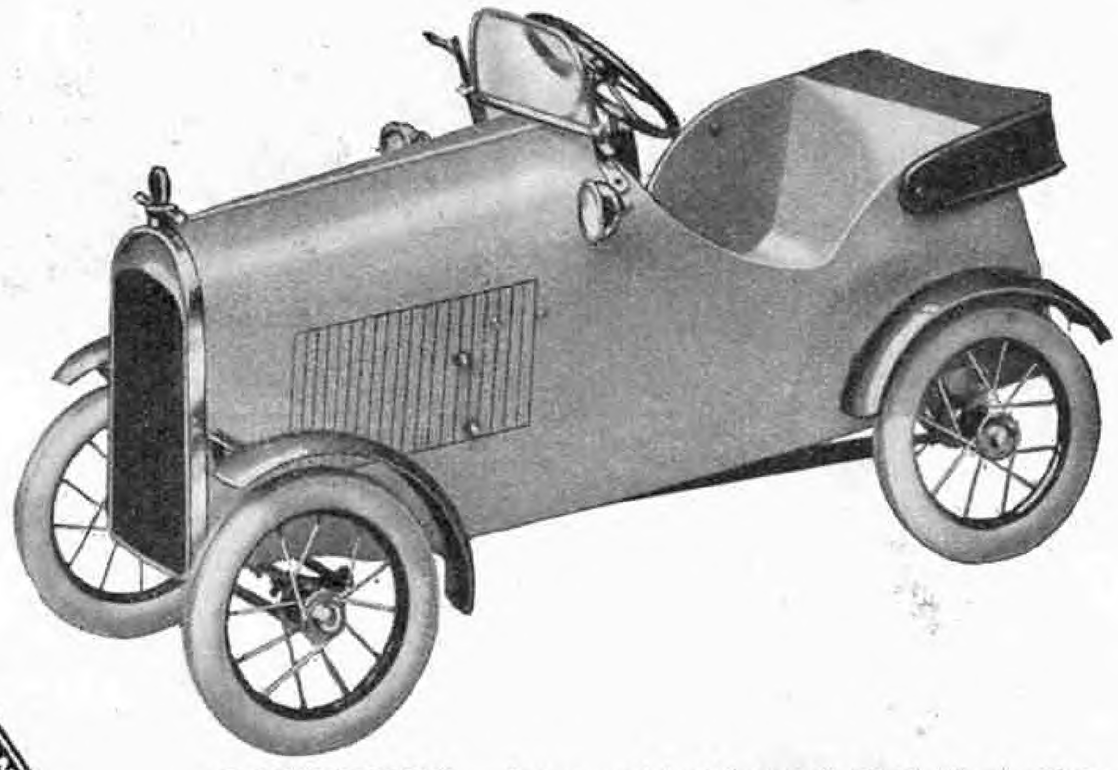
With spare wheel and tyre. Price **78/-**



● BENTLEY SPECIAL. A popular model with all steel body, with opening side door. Adjustable windscreen and plated radiator, 7 in. spoke wheels and thick white sponge rubber tyres. Finished in Blue with red lines. Length 32 ins. Price **30/-**

L. BROS. Ltd. LONDON BROS ENGLAND

Reg. Trade Mark



● WASP SPECIAL. Latest model of Sports Car with Bentley Type Radiator. Wire wheels fitted with thick white sponge rubber tyres, real automobile pattern. Equipment includes two electric lamps, windscreen, direction indicator, mechanical horn and four sports type mudguards. Body finished attractive orange colour with nickel-plated radiator, shell and lamps. Length 37 ins. Price **45/-**

Lines Bros. Ltd., London, S.W.19

Hamleys News

Estd 1760

·HAMLEY·BROTHERS·LTD

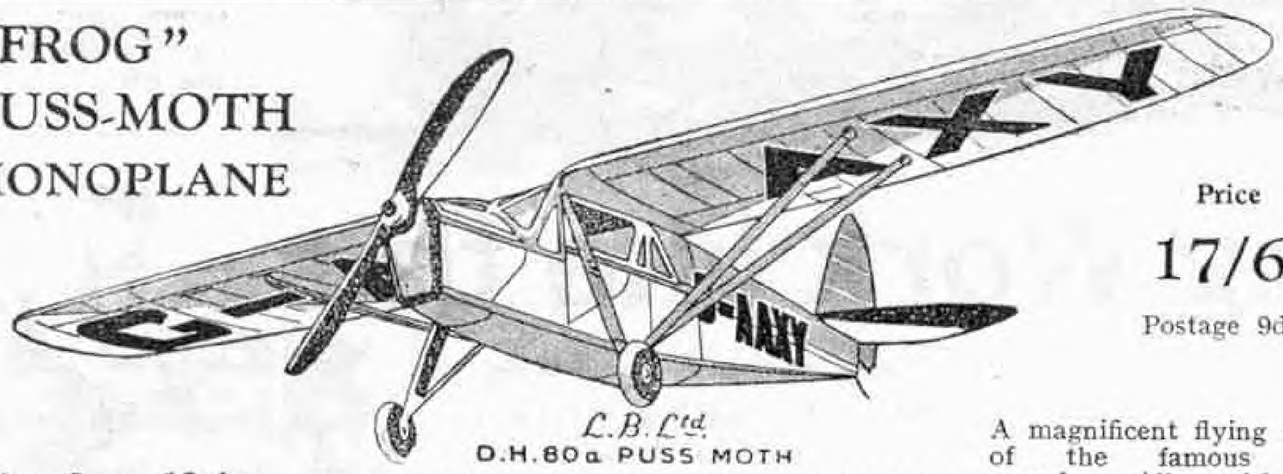
200-202, REGENT ST., LONDON, W.1

Number Eight CHRISTMAS NUMBER *December, 1933*

COME AND SEE THE FINEST DISPLAY OF XMAS TOYS IN LONDON

Hamleys Xmas Toy Show is this year more thrilling than ever! Continual demonstrations of many wonderful new Toys and Models. See them all at Hamleys—Cars, Trains, Aeroplanes and Boats. What a show!

"FROG" PUSS-MOTH MONOPLANE



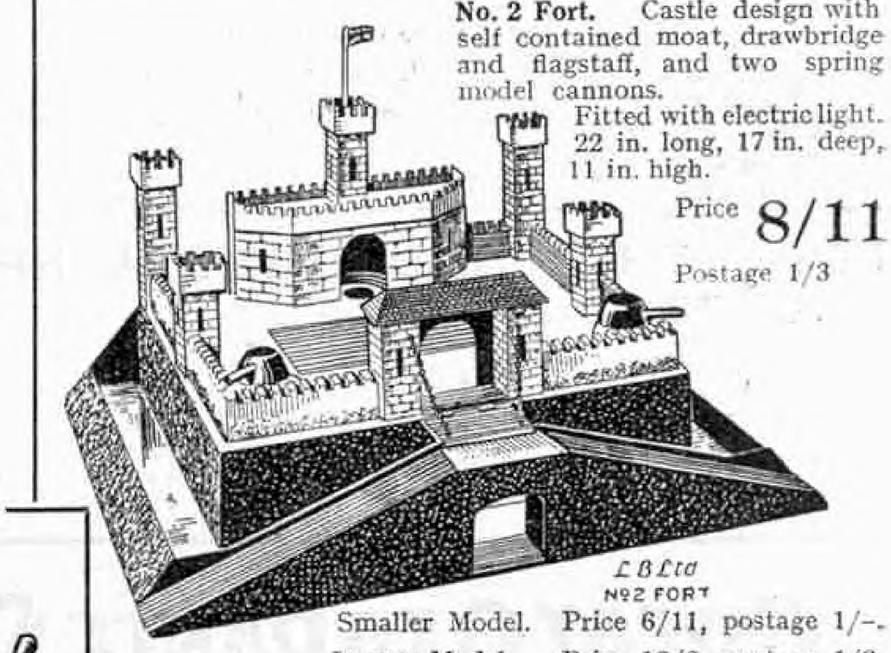
Wing Span 18 in.
Length of Flight 600 ft.
Ceiling 100 ft.

Price 17/6

Postage 9d.

A magnificent flying model of the famous light aeroplane. All metal fuselage with reinforced bulk-heads. Patent wing construction. Dual motor and gear box. Complete with mechanical winder, two spare motors, lubricant, gear box oil and full instructions.

Get your **Tri-ang Toys** from Hamleys. We have large stocks available for immediate delivery. Write for our special coloured Folder of new Tri-ang Toys to Department 5A.

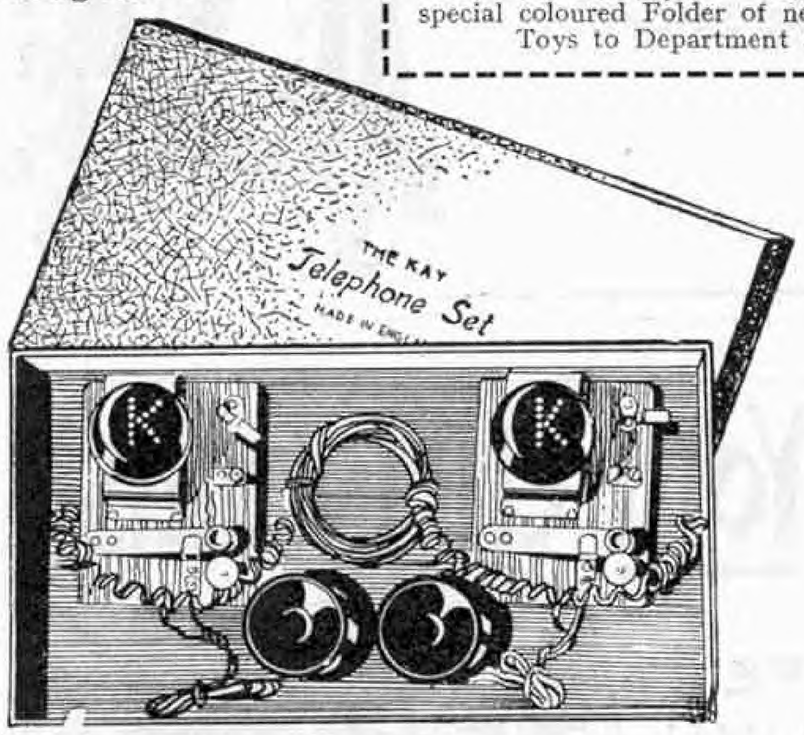


No. 2 Fort. Castle design with self contained moat, drawbridge and flagstaff, and two spring model cannons. Fitted with electric light. 22 in. long, 17 in. deep, 11 in. high.

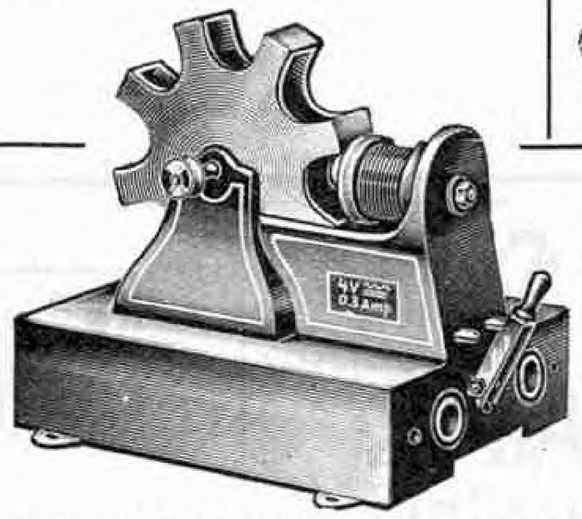
Price 8/11

Postage 1/3

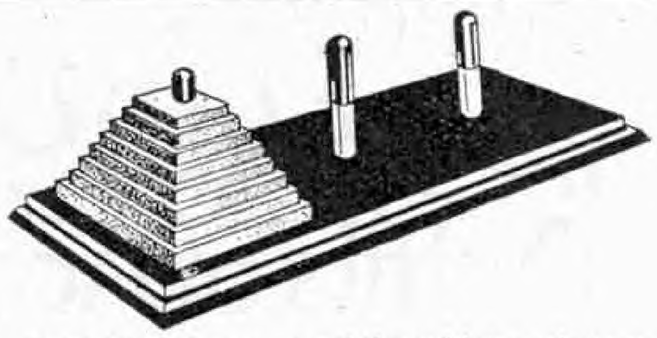
Smaller Model. Price 6/11, postage 1/-.
Larger Model. Price 12/6, postage 1/3.



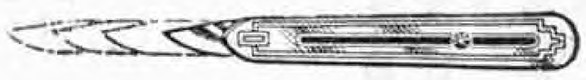
The Kay Telephone Set. A splendid new telephone set at an extremely moderate price. Can be fixed anywhere in the house in five minutes. Only requires a flash lamp battery. Complete with wire, signalling lamp and keys. Postage 9d. extra. **Price** 12/6



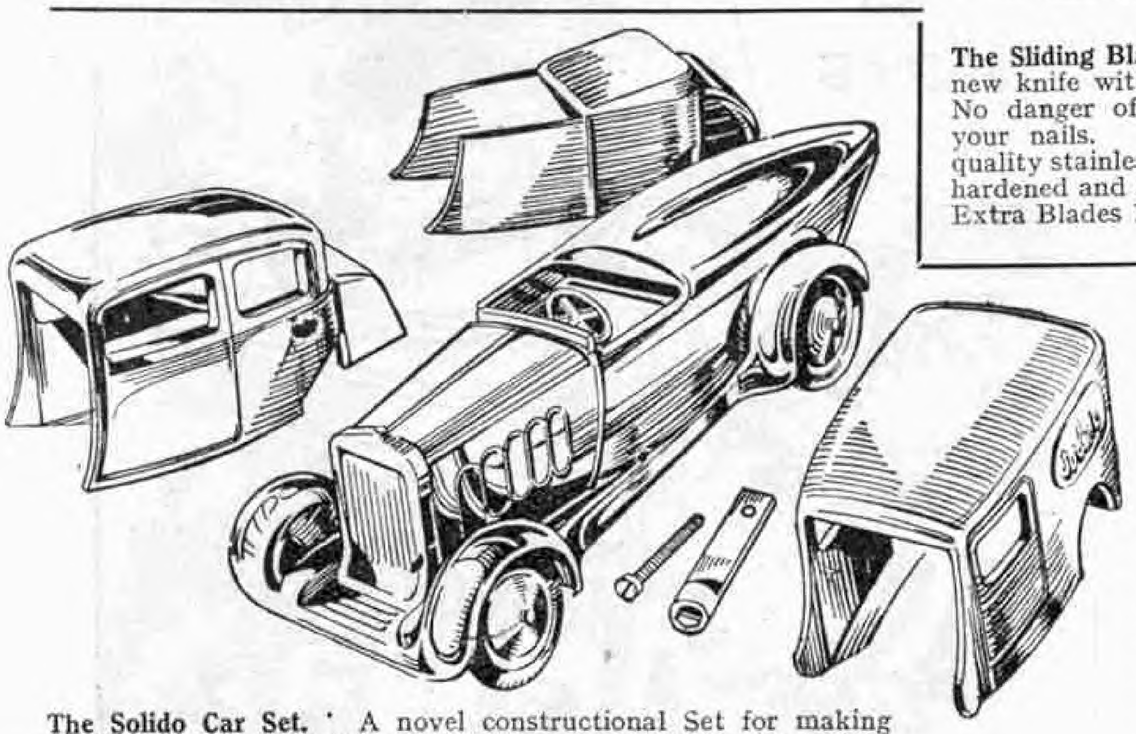
A Novel Electric Motor. Surprisingly powerful. Runs for ten hours on ordinary flash lamp battery. Fitted with control switch. Size of base 3¾ in. x 2¾ in. Wonderful value. **Price** 1/-
Postage 3d.



Pyramid Patience. A subtle and interesting new puzzle-game. A most ingenious discovery. A game you never tire of. **Price** 2/6
Postage 6d. extra.

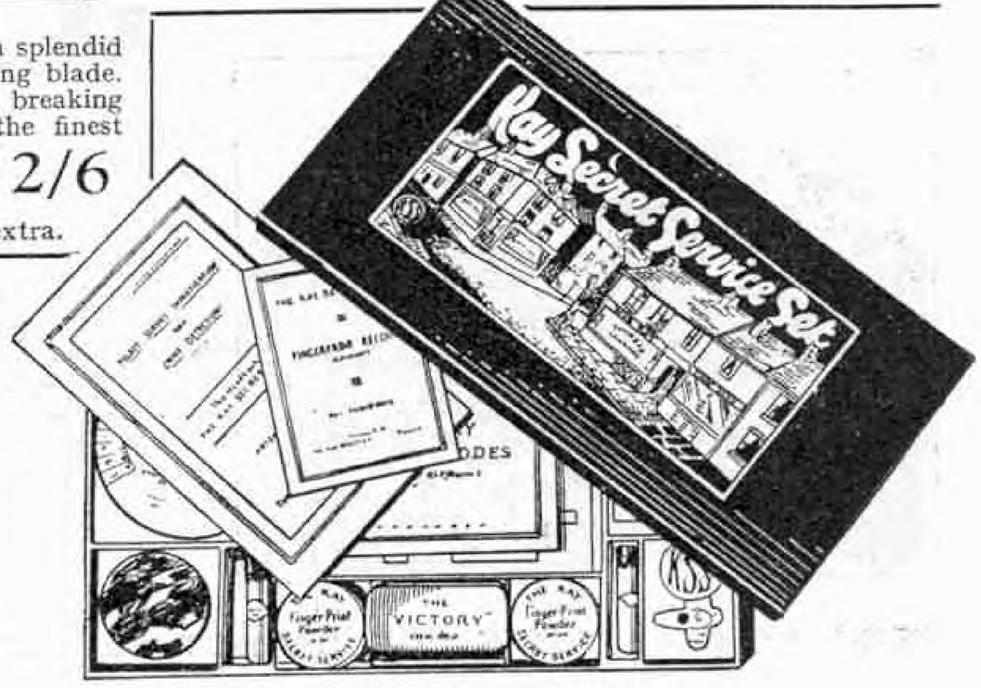


The Sliding Blade Knife. Here's a splendid new knife with a replaceable sliding blade. No danger of cutting fingers or breaking your nails. The blade is of the finest quality stainless steel, scientifically hardened and sharpened. **Price** 2/6
Extra Blades 1/-.
Postage 3d. extra.

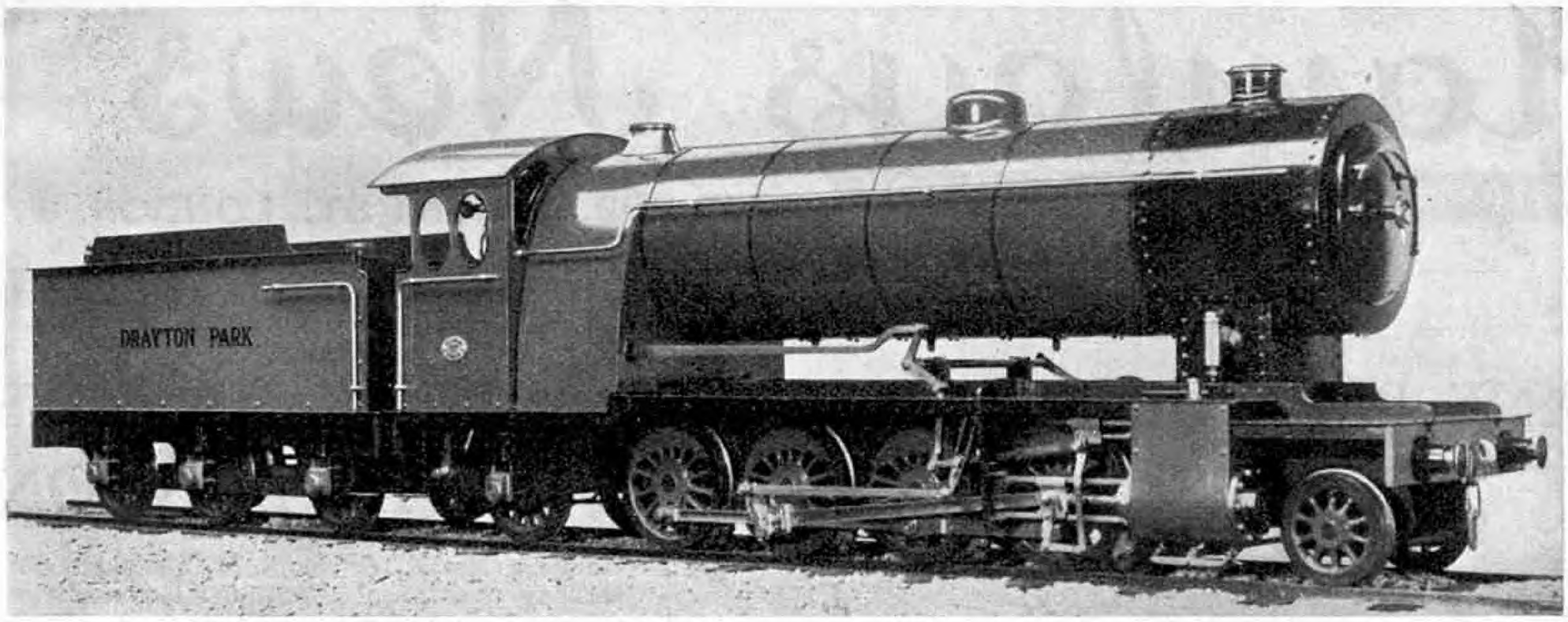


The Solido Car Set. A novel constructional Set for making miniature cars, comprising chassis and four different bodies. Extremely strong, practically unbreakable and handsome appearance. Length 4". (*Foreign*). **Price** 9/6
Postage 6d. extra.

We hold large stocks of Meccano, Hornby Trains and Boats, Kemex and Elektron, and can despatch by return post.



The Secret Service Set. Learn to be a real detective with this new Secret Service Set. Complete outfit for amateur crime detection. Letter code, finger print record, etc. **Price** 2/6
Postage 6d. extra.

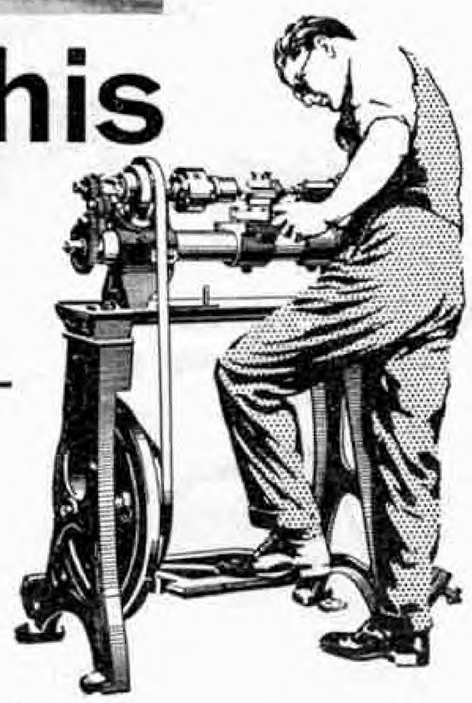


This fine Model

was made entirely on a Drummond 4 in. round bed lathe. The loco and tender are 6 ft. 6 in. overall; gauge 7-1/16 in., width over footplate, 12 in., diameter of driving wheels, 5½ in. The maker says: "I cannot speak too highly of this multi-tool lathe."

Real Engineering Work like this

You can do real engineering work if you have a lathe, the one great essential for model making. The best lathe is worth while, because it is so adaptable to varied work, is strong, accurate, and provides for all kinds of machining. Get a Drummond, the most popular lathe in the world.



POST THIS COUPON

To DRUMMOND BROS. LTD., East Hill, Guildford

Please send me booklets on 3½ in. and 4 in. lathes, post free. (Post coupon unsealed for ½d.)

Name.....

Address.....

GREAT CLEARANCE SALE

APPLEBY'S *Model* AEROPLANE Experimental

Outfits of Accessories

25/- WORTH *for* 3/6



Each Set will give you hours of interesting building, and contains hundreds of new and unused parts which cannot be repeated. Contents include Wheels, Elastic, Propellers, Nails, Cupwashers, Brass-washers, Piano Wire, Cane, Bucket Seats, Propeller Spindles and Bearings, Plans for making Model Aeroplanes and Books for making Model Aeroplanes, also parts for making Paper Gliders up to 24" Span.

SEND 3/6 NOW. THIS LOT CANNOT BE REPEATED

All orders Carriage Paid U.K.

W. E. PEARSON, Receiver and Manager for
WILLIAM E. APPLEBY LTD.,
CLARENDON HOUSE, NEWCASTLE-ON-TYNE 1.

For Your Christmas!

THREE RATTLING FINE BOOKS *for* BOYS



Xmas Gifts You Want

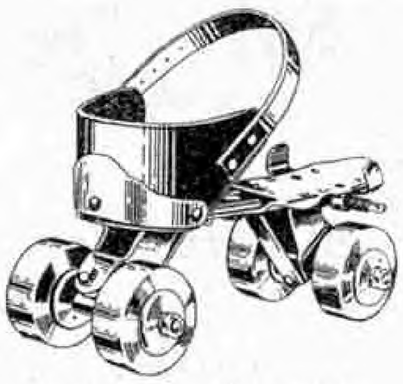
HALFORDS

THE HALFORD PATHFINDER CYCLE

The model for the young speedster. Chromium plated mud-guards, Rubber Sports Handles, North Road Bars with cross-over lever brakes. Price with full equipment including Halford Saddle Bag and Bell.



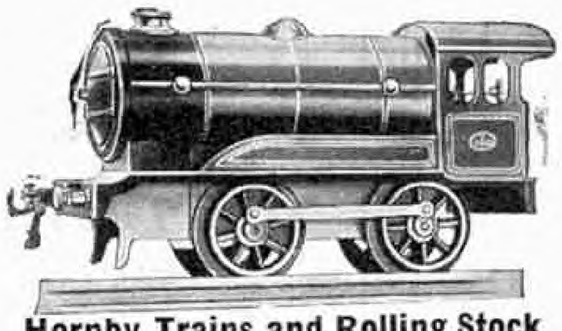
£4 - 5 - 0 cash price.



ROLLER SKATES

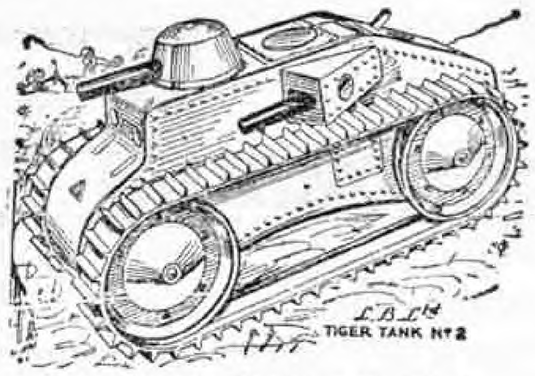
Street Skates from **2/3** pair

Rink Skates from **7/6** pair



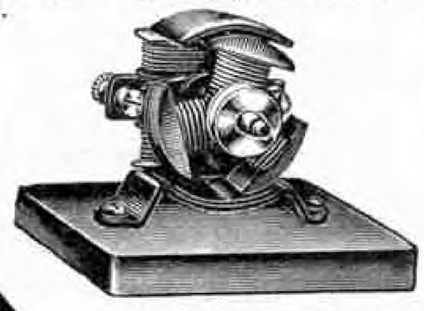
Hornby Trains and Rolling Stock

In every Halford Depot you will see a splendid display of these model railways. Complete train sets from 5/–. Special Lists free. Large selection Meccano Constructional Outfits and Spare Parts.



Clockwork Tanks and Tractors from **6d.** each

If you are interested in working models you will enjoy Halford displays.



Electric Motors from **3/9** each

Dynamos from **3/11** each

Boat Motors from **2/6** each



CHEMICAL and ELECTRICAL SETS

These outfits contain everything necessary for making fascinating experiments, from

KEMEX OUTFITS **7/6**

ELEKTRON OUTFITS from **8/6**

B.G.L. Chemical Sets from **2/-**

B.G.L. Electrical Sets from **7/6**



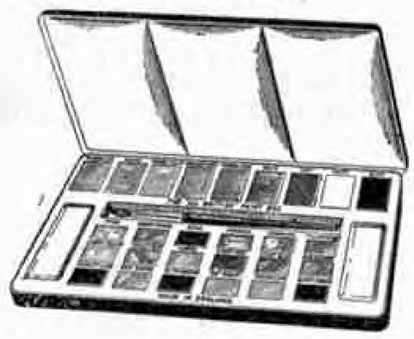
AIR RIFLES

The "Hector" Breech loading. British made, complete with 100 shot **5/11**

Daisy Air Rifles from **7/6**



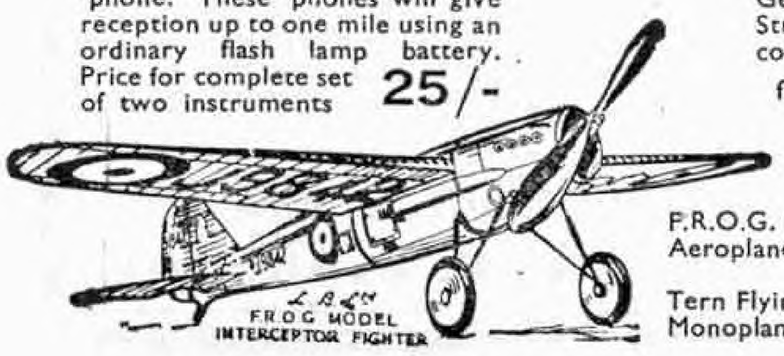
Have you tried the fun of installing and running your own 'phone. These 'phones will give reception up to one mile using an ordinary flash lamp battery. Price for complete set of two instruments **25/-**



PAINTS

British Made Paint Boxes from **6½d.**

Genuine Reeves' Students' Water colours from **2/-** box



F.R.O.G. Model Aeroplanes **7/6** each

Tern Flying Monoplanes **1/6** each

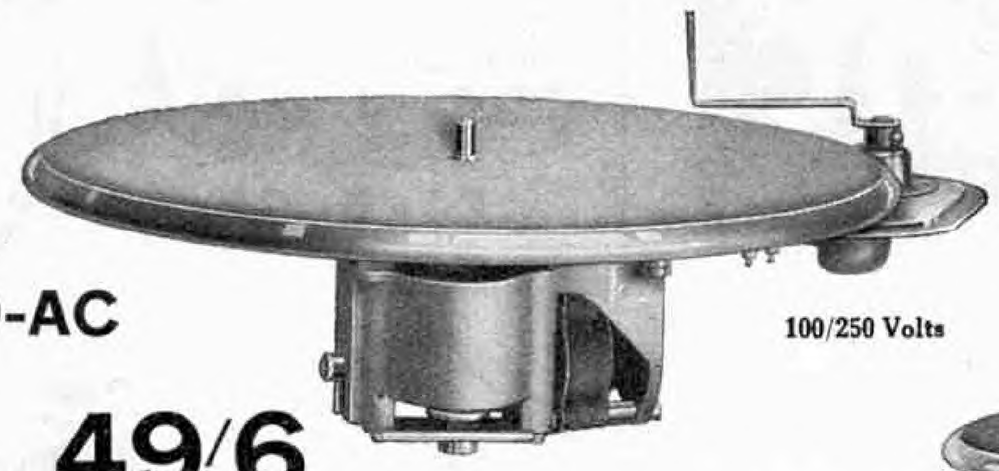
These are only a few of our lines. Get a copy of Halfords 1933 Toy Catalogue—it is packed with sensible gifts. Obtainable Free from any Halford Depot or send a postcard to our Head Office addressed :—

THE HALFORD CYCLE CO. LTD.
239, CORPORATION STREET
BIRMINGHAM, 4

ELECTRIC GRAMOPHONE MOTORS

B T-H

TRUSPEED-AC



100/250 Volts

49/6

The only self-starting synchronous motor offered for gramophone work.

All models fitted with Automatic Stop Switches.

Write for Free Booklet A.G. 455

TRUSPEED-DC

The only gramophone motor on the market built exclusively for D.C. circuits.



100/125 Volts
200/250 Volts

67/6

Other models :
GOLDEN-DISC for A.C. circuits price 67/6
UNIVERSAL for A.C. & D.C. circuits ,, 110/-

BTH RUGBY

THE BRITISH THOMSON HOUSTON COMPANY LIMITED, RUGBY ENGLAND

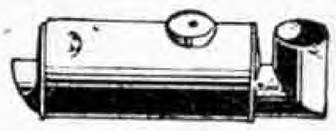
A1561N

Model Marine Steam Engines

OSCILLATING
5/16″ bore x ¾″ stroke.
4/6 each



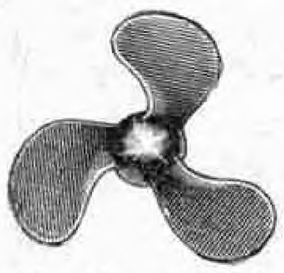
DOUBLE ACTING
Oscillating
⅜″ bore x ⅜″ stroke
5/6 each



BOILERS
Small water tube type. Complete with safety valve and steam tap. 4″ x 2¼″ x 3″. Silver soldered.
8/– each
Plain type, **5**/– each
Silver soldered.

CENTRE FLUE
TUBULAR type
Made from very heavy gauge brass, flanged ends, cast steam dome, bushes fitted, silver soldered.
16/– each

PROPELLERS
Brass



1½″, **8**d. each 2″, **9**d. each

PROPELLER SHAFTS
Complete with stern tube and packed gland.
Rigid type, 7″ long,
11d. each
Flexible type, 9¾″ long,
1/– each

BOAT TYPE ACCUMULATORS
4 Volt, 4 Amp., **5/6** each. 4 Volt, 6 Amp., **6/6** each
STEAM FITTINGS, MODEL ELECTRICAL GOODS
Write for Catalogue, 2d.

F. YATES & SON LTD.
144, Church Street, Kensington, London, W.8



YOURS FOR 10/-

AND 12 MONTHLY PAYMENTS OF 10/9

(Cash Price, £6 6s. 0d.)

The "KELSON"
SOLID OAK WALL CABINET
Contains 50 Best Quality Tools

Made of highly polished solid oak, 32″ high x 20″ wide x 8″ deep. Takes up very little wall space and is a useful article of furniture. Contains 50 best quality tools as used by expert craftsmen ; the edge tools are ground and sharpened ready for use. Also contains complete guide book on Carpentry. Don't miss this wonderful bargain.

CONTENTS 22″ Panel Saw ; 10″ Iron Back Tenon Saw ; Beech Pad Saw and Blade ; 1¾″ Iron Smoothing Plane ; 6″ Rosewood Square ; 7½″ Rosewood Bevel ; 8″ Ratchet Brace ; ⅜″, ½″, ¾″ and 1″ Centre Bits ; Rose Countersink Bit ; Screwdriver Bit ; Beech Mallet ; 2″ Box Handled Screwdriver ; 4″ Box Handled Screwdriver ; ⅜″, ½″ and ¾″ Box Handled Chisels ; ¾″ and ⅝″ Box Handled Gouges ; Beech Marking Gauge ; No. 1 Joiner's Hammer ; No. 00 Tack Hammer ; 6″ Tower Pincers ; 6″ Cutting Pliers ; 8″ Half-Round Wood File ; 8″ Half-Round Wood Rasp ; 8″ Panel Saw File ; 2′ Boxwood Rule ; Joiner's Axe ; 2 Bradawls ; 2 Gimlets ; Oilstone ; Oilcan ; Nail Punch ; 2″ Spokeshave ; 6″ Spirit Level ; Soldering Iron ; Solder ; Tin of Fluxite ; Glue Pot and Brush ; Supply of Glue ; Adjustable Spanner ; Glass Cutter ; Compasses ; Box Rawlplugs ; Joiner's Pencil ; Sand Paper Block ; Tin 3-in-1 Oil ; Marking Knife ; 2 Handbooks ; Nails, Screws.

Send 10/– as first instalment or ask for illustrated folder giving complete details.

ROBERT KELLY & SONS LTD.
Specialists in Meccano Products
41-47, RANELAGH ST., LIVERPOOL

CVS

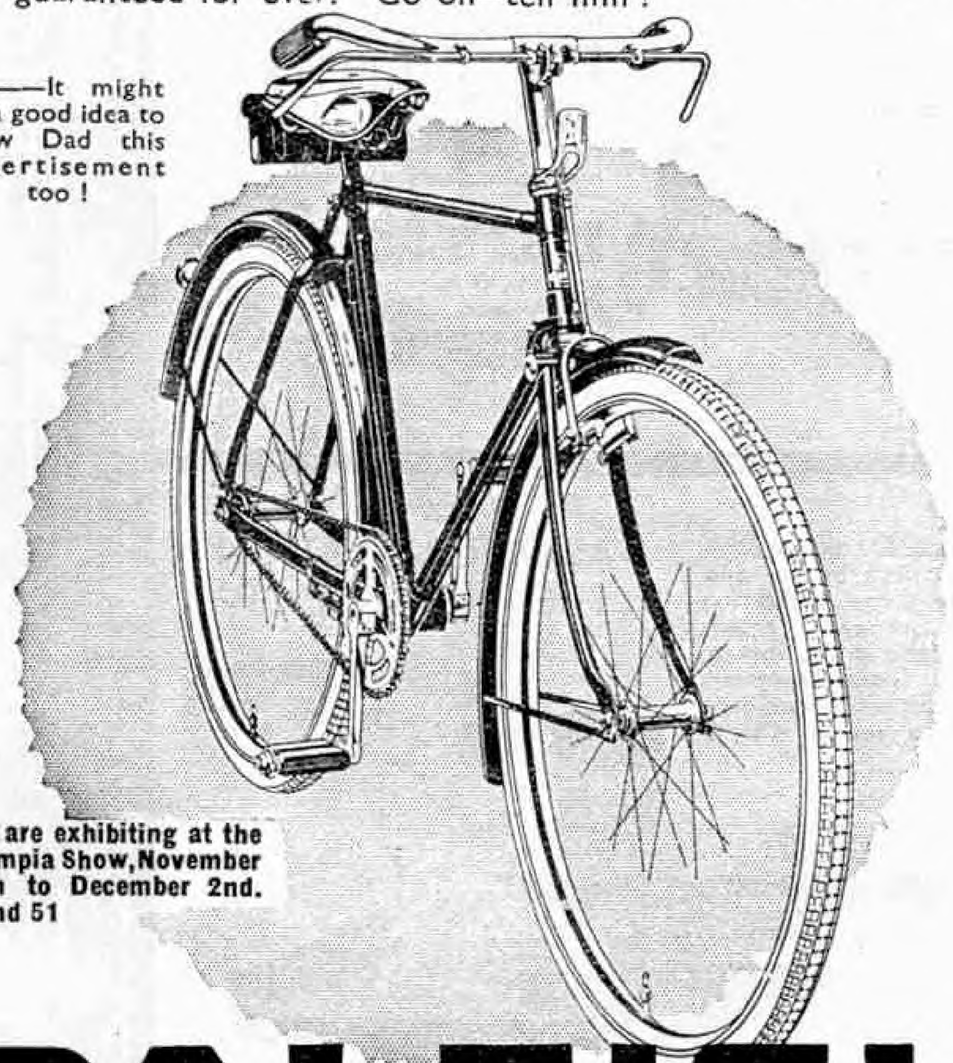
BOYS- do you want a bike this Xmas?

Here is how you can get a RALEIGH *by numbers!*

1. Tell Dad you'd like one—
2. Ask Mother to tell Dad you need one—
3. Concentrate your mind on one !
4. Go to sleep thinking of one !
5. Wake each morning and say—" Every day I'm nearer getting one."
6. Every breakfast-time talk about one—

—and as your Dad's a good sort and knows how much better a RALEIGH is than just a " cheap bike," and costs so little more, he will get you one. Tell him it's an all-steel bicycle, that the enamel never chips, that it has heavier chromium plating, that it's guaranteed for ever. Go on—tell him !

P.S.—It might be a good idea to show Dad this advertisement too !



We are exhibiting at the Olympia Show, November 25th to December 2nd. Stand 51

RALEIGH

THE ALL-STEEL BICYCLE

Fitted with Dunlop Tyres, Brooks' Saddle and the best of everything. Specify the Sturmey-Archer 3-speed gear. 20/– extra

£4 . 12 . 6
(or 12 monthly payments of 9/3)

Send postcard for free copy of "The Book of the Raleigh," and name and address of nearest dealer.

The Raleigh Cycle Co. Ltd., Nottingham. London : 41, Holborn Viaduct, E.C.1

Fit the Sturmey-Archer 3-speed gear—the gear that "makes cycling easy"



TAKE YOUR OWN ELECTRIC LIGHT TO CAMP!

No need to depend on flickering candles or lamps any longer. No need to carry matches. All you want is an Ever Ready torch—the handiest, brightest electric light you ever saw. All you have to do is to press your finger, and a brilliant beam is at your service. The Ever Ready torch can be your very own for as little as one shilling. Choose which model you prefer—the waistcoat pocket torch, the signalling torch, the giant searchlight, or any one of the big Ever Ready range. But make sure that both torch and battery have the name Ever Ready on them ; for Ever Ready torches and batteries are guaranteed satisfactory.



REGD. TRADE MARK.

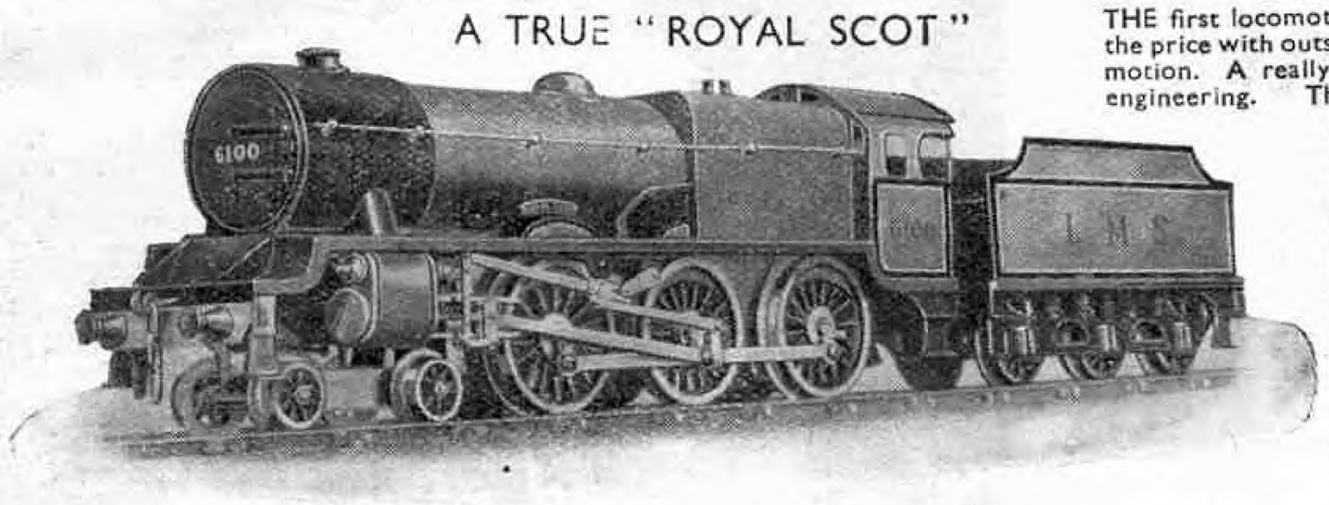
EVER READY

TORCHES & BATTERIES

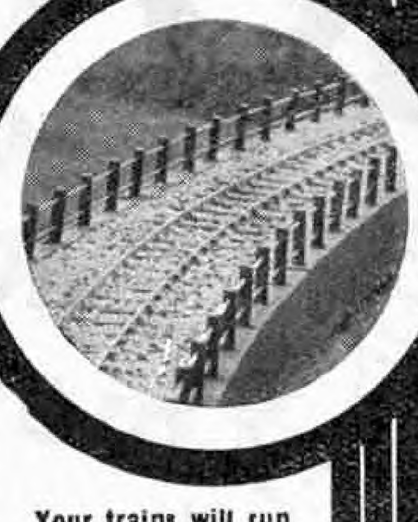
THE EVER READY CO. (GREAT BRITAIN) LTD., HERCULES PLACE, HOLLOWAY, LONDON, N.7.

ADD MORE REALISM TO YOUR RAILWAY

A TRUE "ROYAL SCOT"

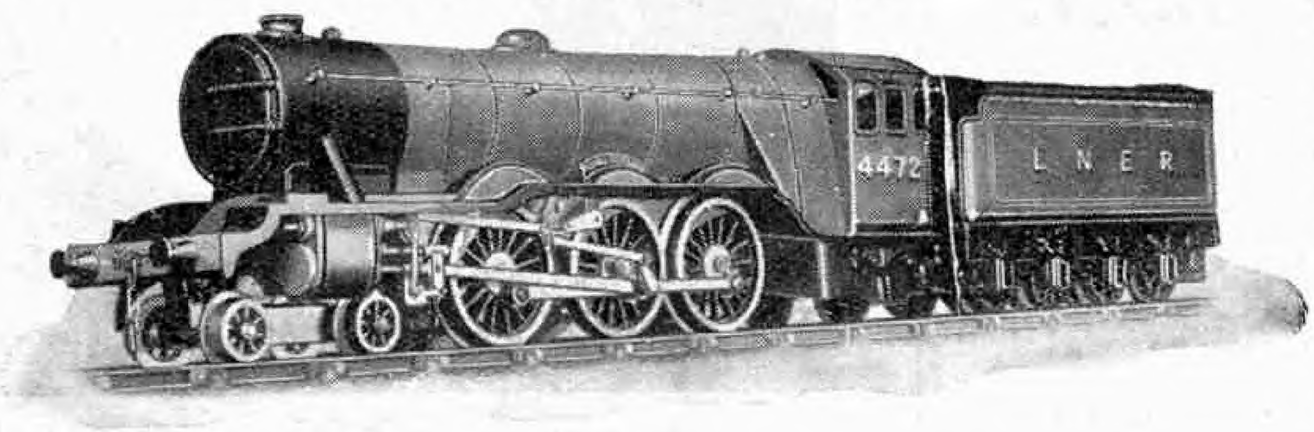


THE first locomotive ever produced at the price with outside Walschaerts valve motion. A really remarkable piece of engineering. The slope of firebox, outside steam pipes, cab with side windows, and squat miniature chimney and dome, are detail which show that she is a true "ROYAL SCOT." Clockwork model, length over all 18 in., **£3-15**. (Same price for D.C. electric model.) Gauge "O," A.C. model, **£3-18-6**.



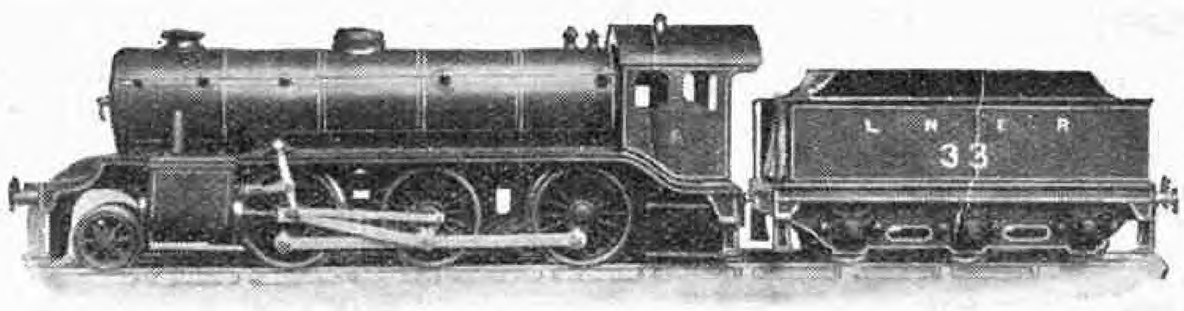
Your trains will run more smoothly over BASSETT-LOWKE track. Heavy solid brass or steel. The best the world produces.

"THE FLYING SCOTSMAN" FOR "NON-STOP" RUNS!



ON hundreds of private tracks the "FLYING SCOTSMAN" has been hauling trains on the longest "non-stop" runs, thanks to her powerful 6-coupled clockwork mechanism. Every external detail is faithfully reproduced, even to the 8-wheel corridor tender with vestibule connection. Only the enormous number in use makes the very low price possible. Gauge O. Length overall, 20¾ in. Clockwork and electric (D.C.), **£4-4**. Electric A.C., **£4-10**.

A MIGHTY "MOGUL"

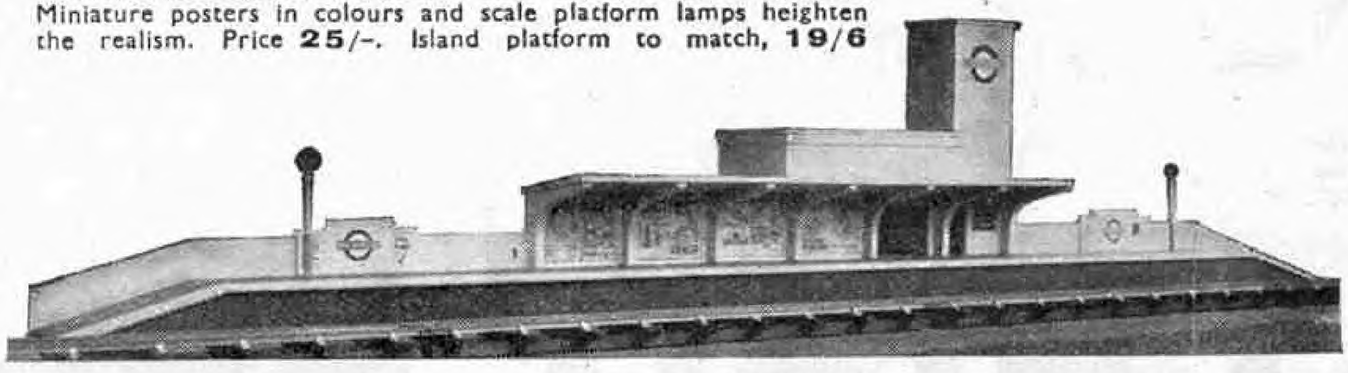


Magnificent hand-made model of heavy express freight locomotive such as you may hear at night rumbling along the track and pulling heavily loaded wagons. Power personified when used for mixed traffic! Walschaert valve motion, outside steam pipe, Ross "pop" safety valves and high-sided 6-wheel tender are faithfully modelled. L.N.E.R., L.M.S., S.R., or G.W.R. Gauge 1¼ in. Clockwork, electric and steam. Length overall, 18 in. **£5-5**.

OUR CATALOGUES
A.17. Model Railways.
B.17. Model Engines.
S.17. Model Ships.
Price 6d. each post free.

Latest Suburban station for gauge "O" traffic built in collaboration with the London Passenger Transport Board. The beauty and simplicity of design is typical of the modern trend in station construction. Hand-made in hard wood, spick and span in cream and blue paint and with a fine stretch of platform 52 inches, "ASHFIELD" station provides a fine stop for your expresses. Miniature posters in colours and scale platform lamps heighten the realism. Price **25/-**. Island platform to match, **19/6**

ASHFIELD STATION THE NEXT STOP!





6D

BASSETT-LOWKE LTD.

NORTHAMPTON

LONDON BRANCH ..... **112, HIGH HOLBORN, W.C.1**
MANCHESTER BRANCH ..... **28, CORPORATION STREET**

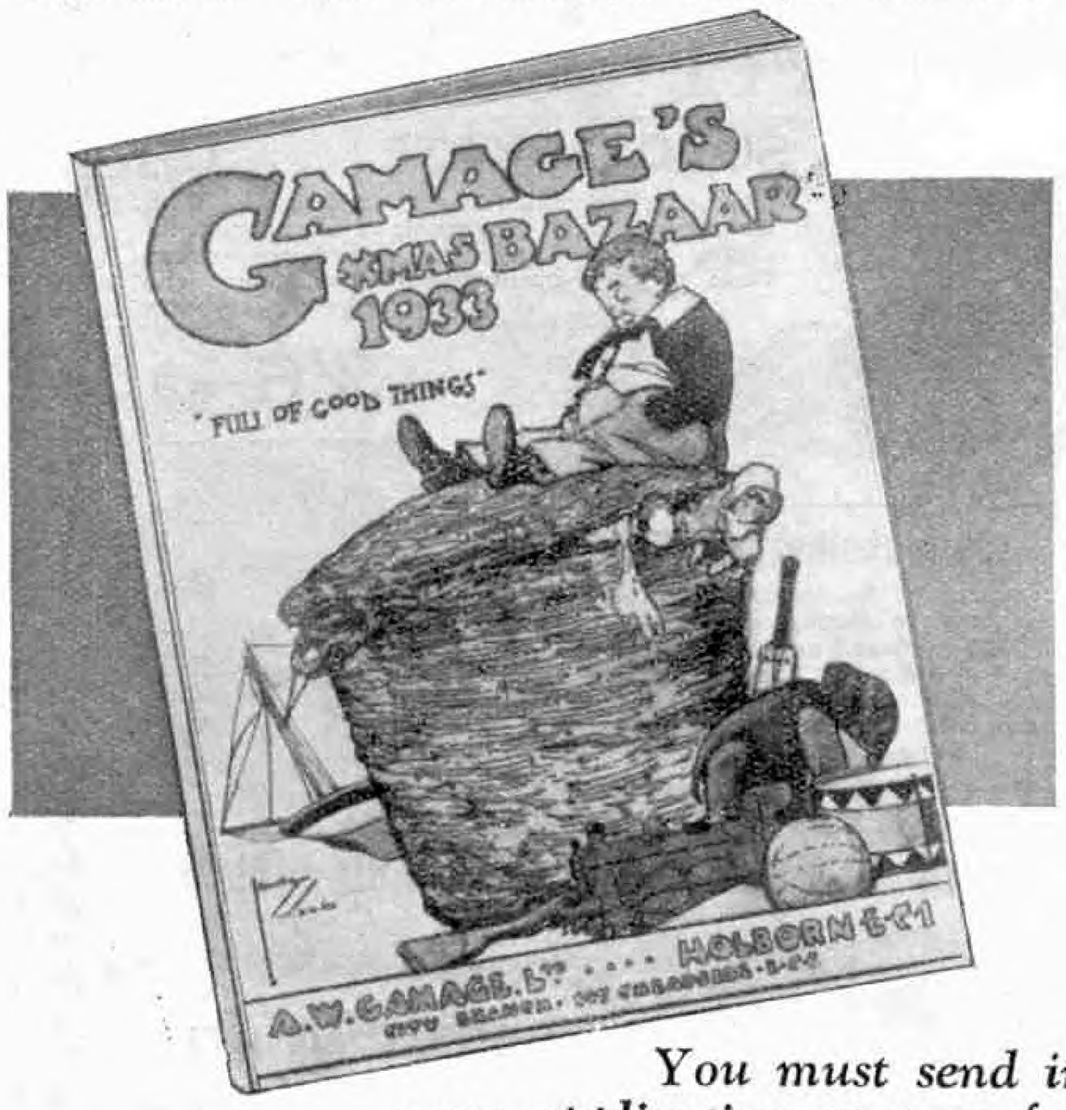
Write for Free Folder, "The Real Thing in Miniature." Catalogue No. A.17, a liberal education in Model Railways will be sent from Northampton post free for 6d.

BARGAINS, BOYS! Many magnificent British playthings, personally selected by us are on view at our Holborn Branch. Pay us a visit or write for folder.

— A Wonderful Welcome awaits You at

GAMAGES Christmas Bazaar

A magnificent array of Toys, Models and Games. A real Circus complete with Animals, Clowns, Acrobats, etc. Father Christmas with his giant Christmas Pudding. The marvellous Radio-Telecontroller. Innumerable displays and side shows. Lovely decorations. What a wonderful time you will have at this great Bazaar—the finest Gamages have ever staged!

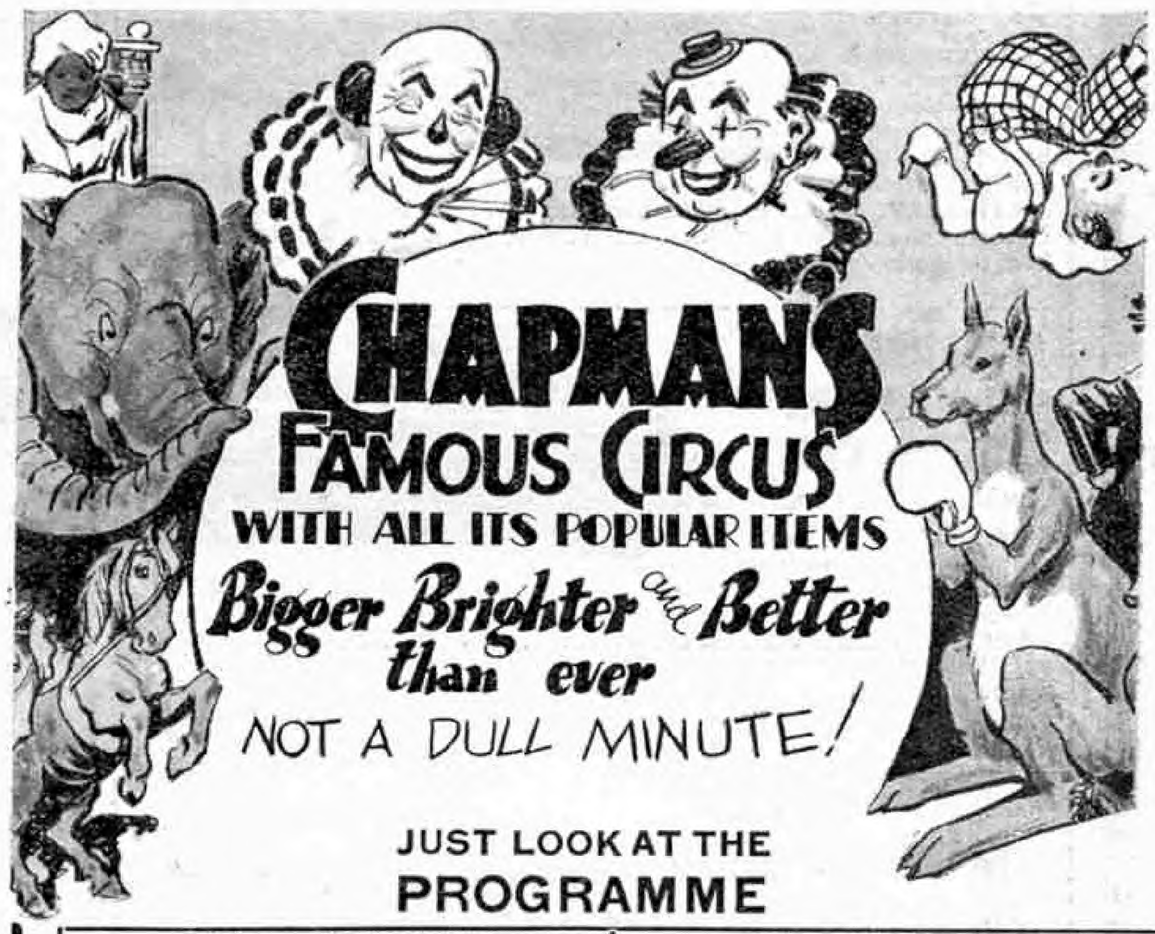


You must send in your application at once for

GAMAGES FAMOUS CHRISTMAS CATALOGUE

Every Post brings in hundreds of applications for this fine book. It has 64 pages beautifully illustrated in photogravure. Full of Toys, Models, Games and Christmas Gifts for Boys of all ages. A book you will want to keep. To avoid disappointment send in the application for your copy now as a strictly limited number of catalogues have been printed.

★ **SEE THE MARVELLOUS RADIO-TELECONTROLLER WITH THE HUMAN BATTERY.** Major Raymond Phillips, O.M.E., the famous Scientist and Inventor, presents the marvellous Radio-Telecontroller. He demonstrates how the human body forms a battery and controls a model railway. He also demonstrates the marvellous new electrical meter which shows how much electricity your body generates.



JUST LOOK AT THE PROGRAMME

FOUR COMEDY BLACK BEARS In their Tea Party, Riding, Tumbling, Swinging and causing great merriment.	**PERFORMING ELEPHANTS** Who will Dance, Dine and Play Musical Instruments, ETC. ETC. ETC.
'APPY 'ARRY AND PARTNER Walk the Wire.	**SIX WONDERFUL PERFORMING PONIES**
CHARIVARI The Clowns and Girls making fun.	**FAY STARR** In her Great Aerial Trapeze Act.
THE YELDINGS FAMOUS RIDING FAMILY In all kinds of Trick and other Riding.	
MANLEY BROS. In their Stupendous Bar Act.	**KEYSER BROS.** Hand Balancers.
BOXING KANGAROO Will Box with its Trainer.	**MISS MILLIE** The Lightning Voltage Rider.

PERFORMANCES :
From DECEMBER 4th to DECEMBER 22nd.
Monday to Friday, at 12, 1, 2, 3, 4, 5 and 6 o'clock.
Saturday, at 10.30, 11.30 and 12.30.
On SATURDAY, DECEMBER 23rd.
at 11, 12, 1, 2, 3, 4 and 5 o'clock.

PRICES OF ADMISSION :
Reserved Seats 1/–, including Tax.
Seats can be booked up to 90 minutes before the commencement of any performance.
Unreserved Seats 7d., including Tax.
Tickets for unreserved seats can only be purchased during the hour preceding performance.

YOU MAY BOOK YOUR SEATS BY POST.

P.T.O.- FOR 5 PAGES OF NEWS & GIFTS

GAMAGES, HOLBORN, LONDON, E.C.1. *Telephone: Holborn 8484.*

GAMAGES • HEADQUARTERS FOR MECCANO & HORNBY

GAMAGES CHRISTMAS GIFT SUGGESTIONS

THREE GAMAGE SPECIALITIES

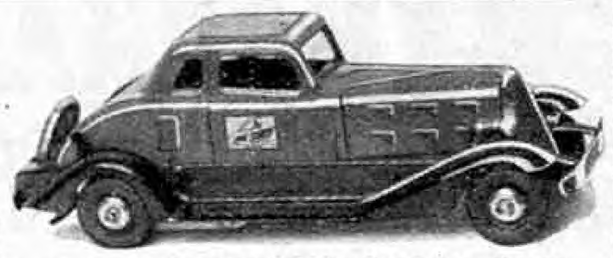
LAUNCH WITH AUTOMATIC STEERING



The amazingly clever feature of this clockwork - driven boat is that it will go out in a straight line, almost 150 ft. and **RETURN AUTOMATICALLY.** Speed is 100 ft. per minute, and it cuts through the water just like the real speed boats. Length, 17 in. overall. Price **18/6** Post 9d.

A WONDERFUL CLOCKWORK MOTOR CAR

(Exclusive to Gamages.)



A perfect model in heavy gauge metal with particularly strong clockwork movement. **FOUR OUTSTANDING FEATURES.** 1. As car runs at high speed a siren is automatically sounded. 2. Two electric head lamps which are operated by a switch to either **"bright" or "dim."** 3. Brake on rear wheel. 4. Car can be steered straight or in a circle. Overall length, 14". Price complete with 2 Batteries, *Foreign.* Post 1/- **12/6**

A REAL MODEL BOAT For the Price of a Toy



This entirely new model yacht folds up and erects easily into the remarkable size of 2½ ft. high, 2½ ft. long, with approximately 300 square inches of sail area. Rigged Fore and Aft. Will carry a cargo of 2½ lb. Guaranteed to sail. Price **7/6** Carriage 1/3



MODEL MACHINE GUN

Truly remarkable value in a machine gun. Fitted on collapsible metal tripod. Can be turned to any direction and elevated to an angle of 45 degrees. Fires roll caps at a very rapid rate, and these are easily fixed. Emits a very loud report and smoke pours from barrel giving a realistic effect. No boy should be without this gun. Length o barrel, 25½". Height of gun, 20½". Price **10/6** Post 1/-

BROOMRANG PUNCH BALL

Provides a healthy pastime for Boys



Boys' Boxing Gloves With elastic wrists. Price **10/6** per set of 4. Youth's **12/6** Post 6d.

Can be attached easily inflated. The ball is fastened to the head by a rubber strano to a strong band, fixed round head. Ball has a good bladder, and reliable quality case. This is great fun for boys of all ages. Price **3/11**

Superior quality **5/6** Post 6d.

THE SCOOTASKATE 3 wheeled.



This very fine skate is adjustable to all sizes, thereby making it serviceable to a youngster for a long period. Is safer than an ordinary scooter. Made of fine quality steel throughout with rubber tyred disc wheels.

Price **3/6** Post 9d.

Boys' Footballs at amazingly Low Prices



We have purchased a manufacturer's entire stock at a large discount and are offering these balls at practically half to-day's value. Made from stout quality hides and being 12-panelled will inflate to splendid shape. Fitted with strong leather tongue securely stitched to case. Reliable quality red rubber bladder and stout leather lace.

Size 1.	Price **1/11**	Postage	6d.
„ 2.	„ **2/6**	„	6d.
„ 3.	„ **2/11**	„	6d.

THE FAMOUS "DIANA" AIR GUNS AND RIFLES



Foreign.

THE "DIANA" AIR RIFLE (Patent)

The Latest Creation in Air Gun Manufacture. Special offer price only **11/3** Post 9d.

Slugs **9**d. 1,000. Darts **4½**d. doz. Post 9d.



THE "DIANA" AIR GUN

The World's Best Air Gun value. Single shot. Muzzle loading. Shoots darts or slugs. Length, 31 in. over all. Special Offer Price **4/11** *Foreign* Post 9d.

NEW HORNBY LOCOS FOR OLD!

Gamages specialise in Hornby Part Exchange Scheme for Locomotives. Write and ask us how you can obtain a new Locomotive for an old one—we will post you a leaflet with full particulars by return.

DYNAMO LIGHTING SETS FOR CYCLES



Here is the finest value obtainable in high-grade Dynamo Lighting Sets. The Set comprises Chromium-Plated Dynamo of modern design. Headlamp with latest dipping device and silvered reflector giving very powerful beam. Red rear lamp and fittings. Equal to sets sold at 21/-. Gamages Price **15/9** *Foreign.* Post 9d.

GAMAGES • HEADQUARTERS FOR MECCANO & HORNBY

GAMAGES, HOLBORN, LONDON, E.C.1.

Telephone: Holborn 8484. City Branch, 107, Cheapside, E.C.2.

GAMAGES • HEADQUARTERS FOR MECCANO & HORNBY

GAMAGES
CHRISTMAS GIFT SUGGESTIONS

BUILD THIS WORKING MODEL CLOCK

Here's a grand constructional set which, when assembled, is a real clock with a 30-hour movement. An accurate timekeeper, too. The complete set of parts and simple instructions costs you only **2/11**

Post 4d.

Thousands of this popular model have been sold.





GAMAGES CONJURING TRICKS

The immense popularity of Gamages Boxes of Conjuring Tricks is due to the wonderful value offered. This year all boxes are better equipped than ever. Every box contains a grand assortment of mystifying tricks. Box A, as illustrated, complete with full instructions. Price **7/6**

Post 6d.

Don't forget to send for Gamages Xmas Catalogue



PRACTICAL TOOL SET

Here is a tool set which is more than a toy. Can be used for all practical purposes. Will give hours of fun to the ingenious boy. All tools are finished in best materials.

10 TOOLS. Price **5/9**

Smaller size, but with 11 tools. Price **3/9**. Postage 6d.

Smaller size, but with 9 tools. Price **2/9**. Postage 4d.

Smaller size, but with 6 tools. Price **1/6**. Postage 3d.

GAMAGE CHEMISTRY SET

This set contains 23 chemicals (of which 7 are contained in test tubes with rack which may be removed from the box when working), Bunsen burner, filter funnel, filter papers, Florence flask, measuring scoop, large test tube, trays, glass tubing, and a booklet of instructions for carrying out experiments. Price **5/-**

Postage and Packing 9d.

Send for list of higher priced sets.



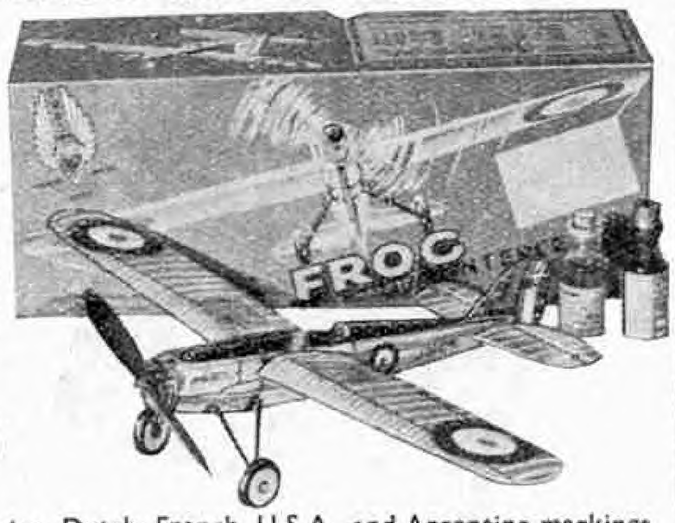
GAMAGES ARE MODEL AEROPLANE SPECIALISTS

Experts demonstrate all the latest and best model Aircraft at the special flying ground on the first floor.

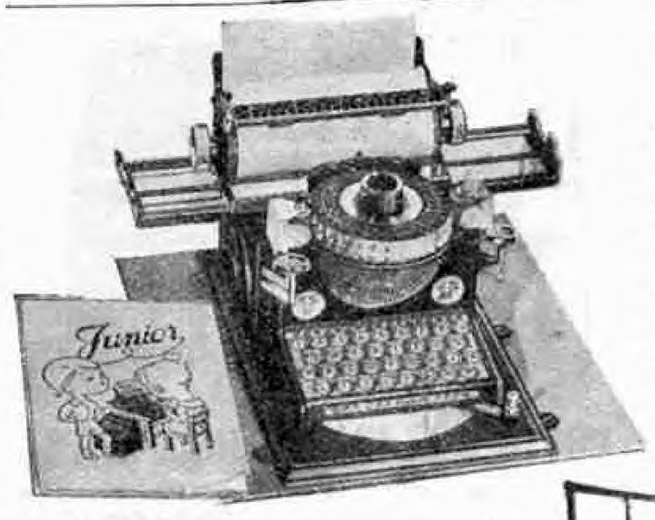
THE FAMOUS F.R.O.G. MODEL AEROPLANES

Without a doubt the most scientific model aeroplane ever made. Has many novel features: collapsible wings, undercarriage and gear-box, making it practically unbreakable. FLIES RIGHT OFF THE GROUND with a run of 8 ft., and travels 75 yards, or when hand-launched 100 yards. Supplied in box with patent winder, inserter rod for new motors, motor lubricant and Shell Oil, R.A.F. markings. Price **7/6**

Post 9d.



Also supplied in Italian, Belgian, Dutch, French, U.S.A., and Argentine markings at the same price.



THE GAMAGE JUNIOR TYPEWRITER

An Ideal Present for a Boy. This machine is fitted with metal type and is complete with ribbon. Easy to work and types clearly. Full alphabet. Capitals, and small letters, figures, stops. Paper 3¼" wide. Strongly constructed and well finished. Price **12/6**

Post 9d.

WARNEFORD "DEMON" MODEL AEROPLANE



A very popular flying model of sturdy construction. Fitted with patent shock-proof chassis, and covered with yellow proofed silk. Will rise from the ground and has a flight of 300 yards, undoubtedly a fine performance for a machine of this price. Wing span, 23 in. Length, 25½ in. 10-in. propeller. Price **7/6**

Post 9d.

STUDENT'S MICROSCOPE

Manufactured by a leading scientific instrument manufacturer. Heavy metal body, crackle enamel finish. Focussing by sliding tube. Magnification 25X. Inclinable stand. Complete in cardboard box with two plain slides and one specimen slide.

Wonderful value. Price only **12/6**

Post 6d.



Foreign

Ensign Cupid Camera



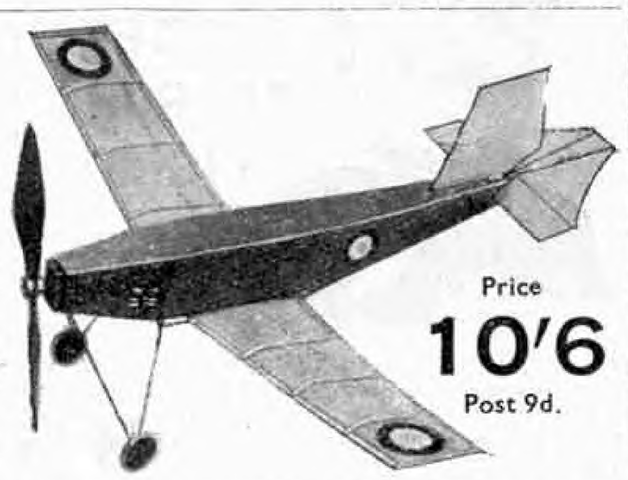
Offered at half-price. A remarkably fine camera for the young beginner, as it is so economical to use. It takes 16, 2⅛" × 1⅝" pictures on a standard 8 exposure film (2¼" × 3¼"). Original list price 21/- without portrait attachment, which we include free. Absolutely new and guaranteed. Price **10/6**

Post free

Waterproof tan canvas case with shoulder strap, 1/6.

GAMAGES FUSELAGE MONOPLANE

Scientifically constructed and designed. Will rise from the ground and fly very steadily—even in strong winds. Fuselage covered in silk and silver coloured. Wings and tail-plane of yellow proofed silk. Can be adjusted to do various stunts. Span, 26 in. Length, 21¼ in. Strongly recommended.



Price **10/6**

Post 9d.

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GAMAGES, HOLBORN, LONDON, E.C.1.

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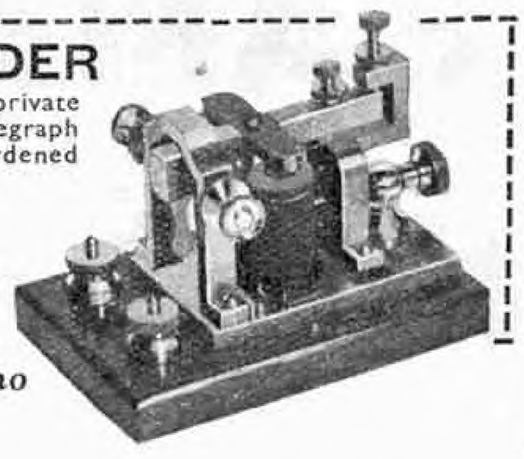
GAMAGES • HEADQUARTERS FOR MECCANO & HORNBY

GAMAGES CHRISTMAS GIFT SUGGESTIONS

Send for copy of Gamages Xmas Catalogue. It contains many Electrical Specialities.

TELEGRAPH SOUNDER

Designed specially for amateurs and private line work, but can be used in any telegraph circuit. The lever and anvil are of hardened brass and give a clear, sharp sound when operated. Well constructed and finished. Resistance 20 ohms. Usual Price 21/–.
Gamages Clearance Price **5/-** Post 9d.



Send for Gamages Meccano and Hornby Booklet.



A WORKING MODEL TELEPHONE —Makes a Perfect House 'Phone

Whether they are used merely as a toy or to save unnecessary journeys in the house, Gamages Telephones can be fixed anywhere in the house within five minutes, the only power required being a flash-lamp battery, which will last for three months.

The model illustrated consists of a polished Bakelite Pedestal and Telephone, and the Signalling Buzzer is housed inside the pedestal. Calling is entirely automatic ; immediately the instrument is removed from its base the signal is given by the distant set.

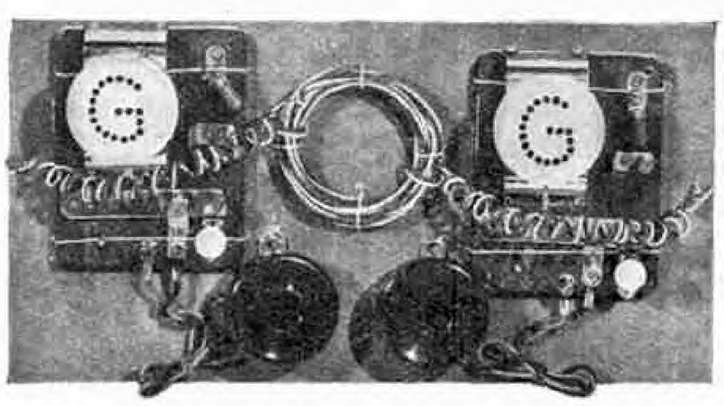
Although an ordinary pocket battery is used this wonderful set will give telephone communication up to one mile. Battery 4d. extra. Price **25/6**
35-ft. Flex is supplied. Extra Flex—50 ft. 4/–. 100 ft. 7/6.





THE KAY ELECTRICAL SET

The set, as illustrated, is comprised of a medical coil, three lamps, insulating tape, two-way switch, battery tester, screwdriver, wander plugs, flex, staples, bell and bell push. Price **10/6** Post 9d.
Other sets 3/6, 5/6, 7/6 and 21/–.



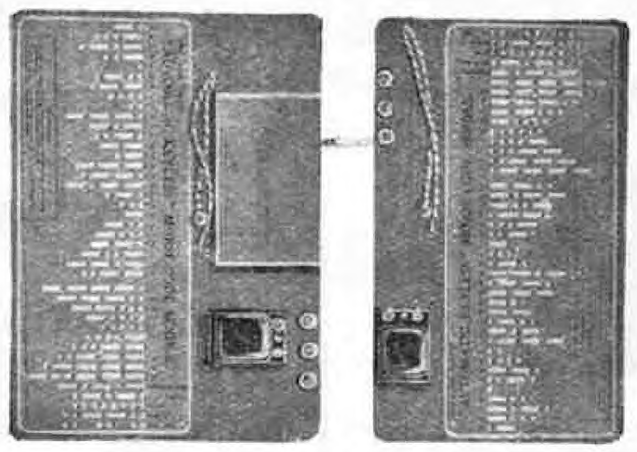
A HOUSE TELEPHONE for 12/6

No construction necessary. Merely insert an ordinary pocket battery and the telephone is ready for operation. Audition is perfect over long distances. It is not even necessary to speak close to the mouth piece as the Carbon Granule Transmitter acts as a microphone. **FLASHER SIGNALS.** Price **12/6** Post 9d.
15-ft. Coil triple bell wire supplied with the set. Extra lengths : 30 ft., 1/6 ; 60 ft., 3/–.



THE B.G.L. ELECTRICAL SETS

A series of sets which demonstrate the principles of electricity in a manner fascinating to every boy. Set No. 1 contains apparatus and instructions for carrying out many interesting and instructive experiments in electricity and magnetism. Price **7/6** Post 6d.
Other prices 12/6, 18/6, and 27/6.



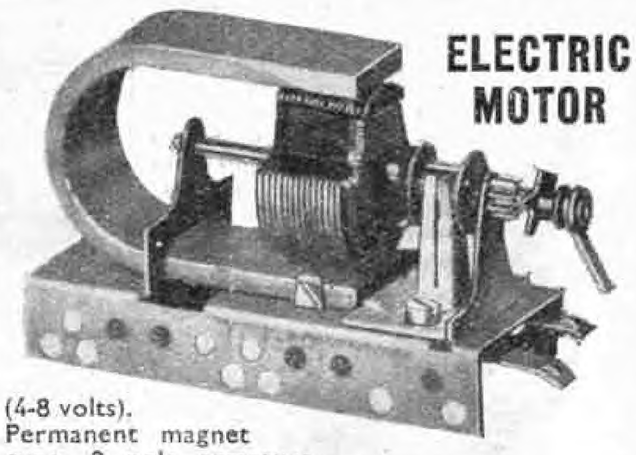
AUTOMATIC MORSE CODE SENDER

The latest idea in Morse Code Sets. Amusing and instructive. The easiest and quickest method of learning the Morse code. Just slide the key slowly over each letter as required, and this is transmitted to the receiver at the other end of the buzzer. Price **10/6** Post Free.



MODEL SEARCH-LIGHT

Will throw a beam of light 40 ft. in the air. Strongly made and finished in black. Replaceable battery fits in base. Dimensions : Height to top of light, 4½ in. Size of base, 4 in. x 3 in. Diameter of lens, 2 in. Price complete with battery **3/9** Post 6d.



(4-8 volts). Permanent magnet type, 3 pole armature, self-starting. Can be used for models or speed boats, and is operated by either one or two pocket-lamp batteries, as desired. Price **3/11** Post 6d.
(Cheaper model 2/6.)

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GAMAGES CHRISTMAS GIFT SUGGESTIONS

WONDERFUL BARGAIN!

GENUINE "KODATOY" PROJECTORS AT UNDER HALF ORIGINAL PRICE



Here is an opportunity to secure a genuine 16 m.m. Kodak Projector at the price of a toy! This Cinema works off house mains—simply plug in (any voltage). Well defined brilliant pictures are obtained. The films are non-inflammable and absolutely safe. Supplied with its own Model Theatre, a silvered screen, and complete with three Films. A wonderful Christmas opportunity.

Originally listed at 3 Gns.
Gamages Price **25/-**

Extra Films: 7 ft., 9d.; 15 ft., 1/6; 25 ft., 2/6; 50 ft., 5/-. Various titles.

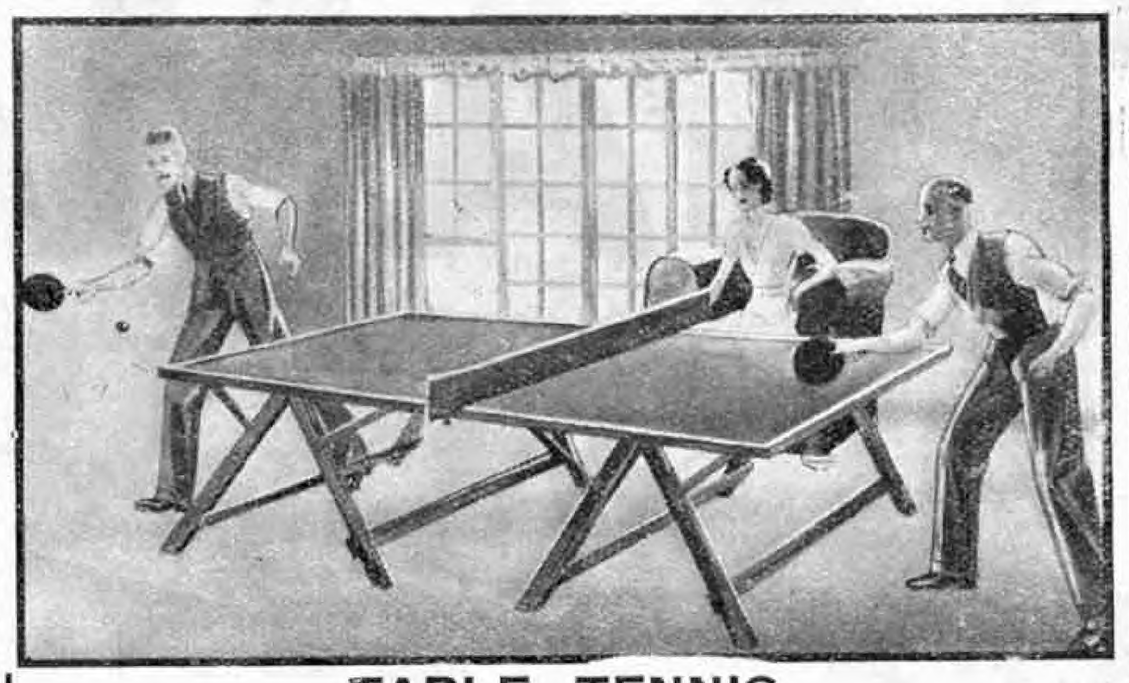


TABLE TENNIS

We have the finest selection in the country of Sets, Tables, etc., for this popular Game, and offer the best value. Here are some typical examples:—

TABLE TENNIS TOPS. 8′ x 4′ x ⅜ in. top, on strong battens, painted green with white line ... ... Price **25/-**
Size 9′ x 5′ x ⅜ in. top, on strong battens, painted green with white line ... ... Price **30/-**
TRESTLES ... ... Price **17/6**

Carriage Extra outside our extensive Van Delivery Area.

TABLE TENNIS SETS No. 1. 4½ ft. net, 2 cork and sandpaper bats with leather handles, upright clamps, 5 English Balls. PRICE **2/6**. Post. 6d.
No. 4. Four Player Set, 5½ ft. net, 2 rubber and sandpaper, and 2 cork and sandpaper bats, extending clamps, 6 English Balls. PRICE **5/6**. Post. 9d.

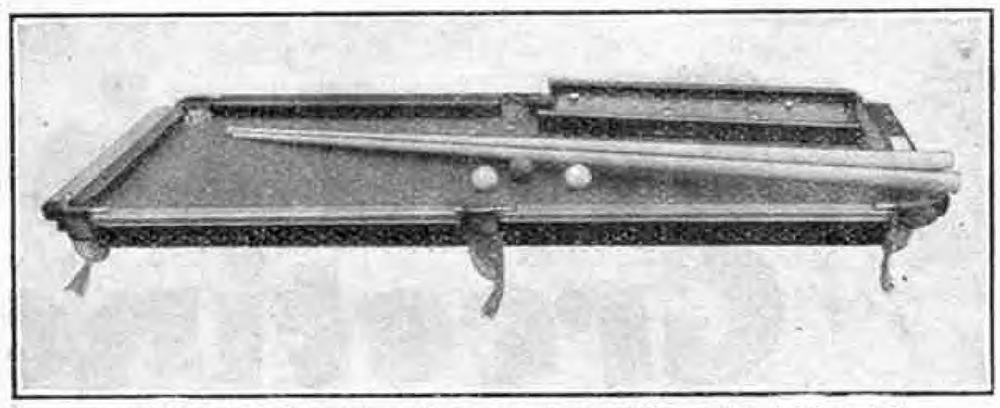
ASKALITE

An amusing and educational toy. Contains 48 metal studs, over which a perforated sheet bearing questions and answers is placed. Complete with 288 questions and answers. As soon as a correct answer is found the light automatically flashes.

Price complete with battery **2′11**
Post 6d.

EXTRA SETS OF QUESTIONS EXCLUSIVE TO GAMAGES, 6d. per packet.





MINIATURE BILLIARD TABLES

Show this to Dad and point out what a wonderful attraction one of these tables will be in the home. Specification:—Adjustable legs, compo. board bed, covered with good green cloth, rubber cushions, cues and set of composition balls, marking board, etc.

3 ft. 0 ins. Oak or Mahogany ... ... **19′6**
3 ft. 6 ins. „ „ **23/6**
4 ft. 0 ins. „ „ **35/-**
5 ft. 0 ins. „ „ **55/-**

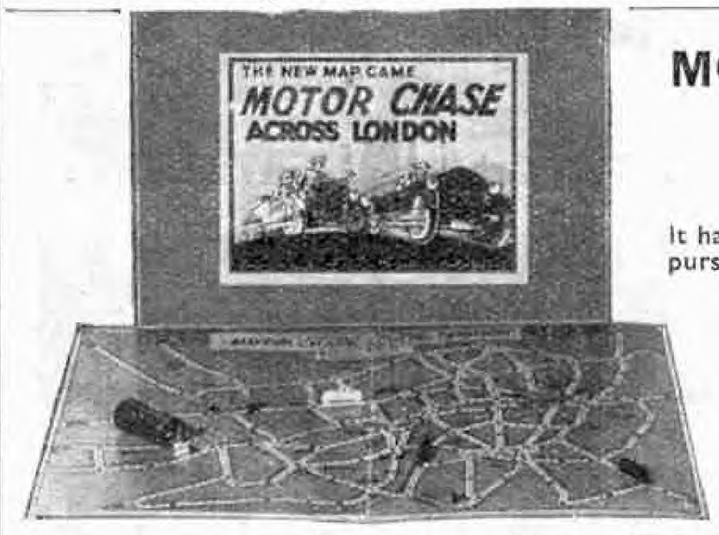
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COMPENDIUMS OF GAMES



These compendiums contain the most popular games, including all the old favourites. Games for old and young, party games, games of skill, etc., will all be found in GAMAGES COMPENDIUMS.

No. 1. Contains 21 games. Price **3/-**. Post. 6d.
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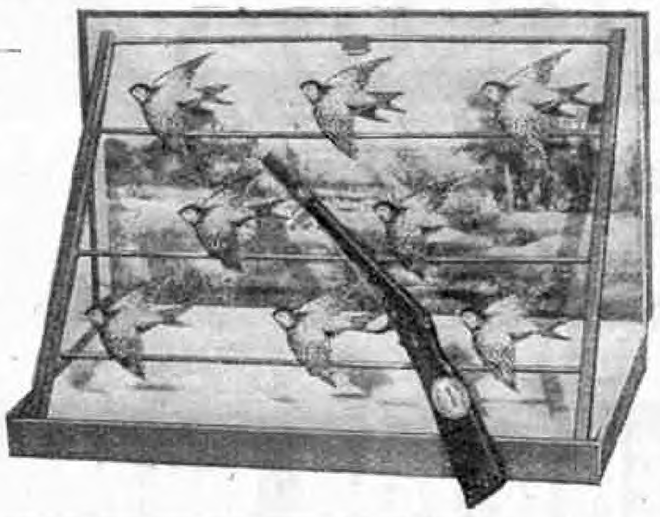
MOTOR CHASE ACROSS LONDON

It has all the thrills of an exciting pursuit through the great metropolis. The hazards are many. Hold-ups, diverted and congested traffic, blocked roads, etc.
Price complete **2′6**
Postage 4d

PIGEON SHOOTING GAME

This game takes the form of a shooting gallery in which pigeons are fixed to strings running horizontally. When hit the pigeons turn over. Boxed complete with pop-gun.

Prices **4′11 & 2′11**
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Send the Season's Greetings to all.

MECCANO CONSTRUCTIONAL SETS

ELEKTRON ELECTRICAL OUTFITS

KEMEX CHEMICAL OUTFITS

HORNBY LOCOS

SPEEDBOATS ETC.

To the great host of Meccano and Hornby enthusiasts the best of everything this Christmas and for 1934.

Whether you are a newcomer or already experienced in the thrills and pleasures of the Meccano and Hornby Boy, you will find that Gamages, as National Headquarters, offer by far the most complete and expert service in the Kingdom. Our huge stocks of all Meccano and Hornby lines enable us to give prompt delivery, while the advice of our staff of specialists is yours for the asking. Specially enlarged Meccano and Hornby displays are an outstanding feature of the giant Christmas Bazaar now being staged.

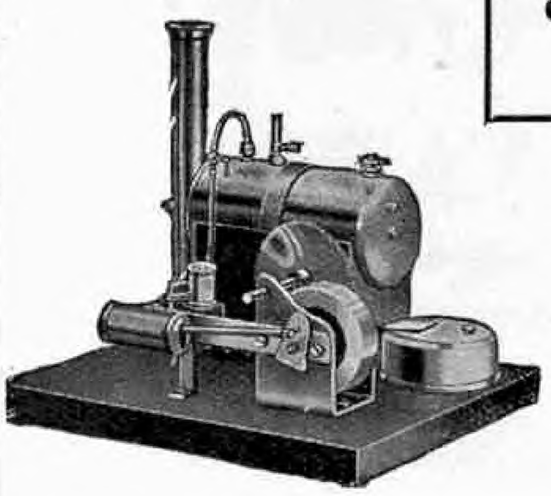
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WANTS FOR BOYS

A wonderful selection of instructive presents for Boys

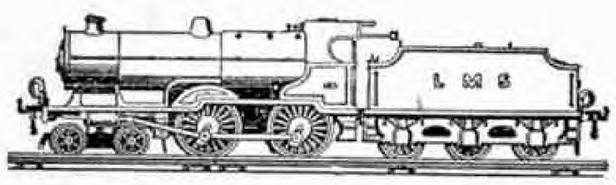
- CHEMICAL OUTFITS
  from **2/6** to **£3-3-0**.
  Meccano Ltd., Lotts Ltd., and Kays.
- ELECTRICAL OUTFITS
  from **2/6** to **50/-**.
  Meccano Ltd., Bowman, and Kays.
- CONJURING OUTFITS
  Wonderful Mysterious Tricks.
  Outfits **1/-**, **2/6**, **5/-**, **10/6**. Full instructions.
- FLASH LAMPS AND TORCHES
  from **1/-** each. Only best batteries.
- AEROPLANES
  All the well-known makes.
  Tern, **1/6**. Warneford, **2/6** to **21/-**. F.R.O.G., **7/6**.
  Skybirds and Xactus.
  ALBATROS that flew the Mersey. Plans, **6/-**.
  Complete Machine, **50/-**.
  Aeroplane Parts and Balsa Wood in stock.
  Splendid selection.
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  Electric, Steam and Clockwork, from **3/11**.
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  All Prices from **2/6** to **£4-10-0**.
- MODEL BOAT FITTINGS
  At Moderate Prices.
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  and accessories. We are agents for Hornby, Bassett-Lowke Ltd., Mills Bros., and Leeds Model Co.
- BUILD YOUR OWN RAIL TRACK
  Get our new list of prices.
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  Agents for Hobbies Ltd. A wonderful Catalogue, 6d. Designs, Tools, Timber, and Fret Machines.
- MECCANO
  from **1/3** to **415/-**. Price Lists Free.

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IT'S THE FLASHING REAR LIGHT—THAT COUNTS

FLASHES OFF & ON



NIGHT RIDE IN SAFETY!

Reflectors and ordinary rear-lamps have their points, but this NEW device beats them all—it *flashes* a compelling red beam that unfailingly attracts the attention of an overtaking rider or motorist. The flashing red light is a *proved* safety device on cross-roads. Now put it on your machine and ride in SAFETY. Absolutely reliable.

Made in Birmingham under British Pat. No. 361,120

COMPLETE SET **6/11** less battery *WITH* **AUTOMATIC — FLASHING REAR LAMP**

SOLE PRODUCERS:

BAEDEKERS Ltd.,

109-11, Northwood St., St. Paul's, BIRMINGHAM, 3

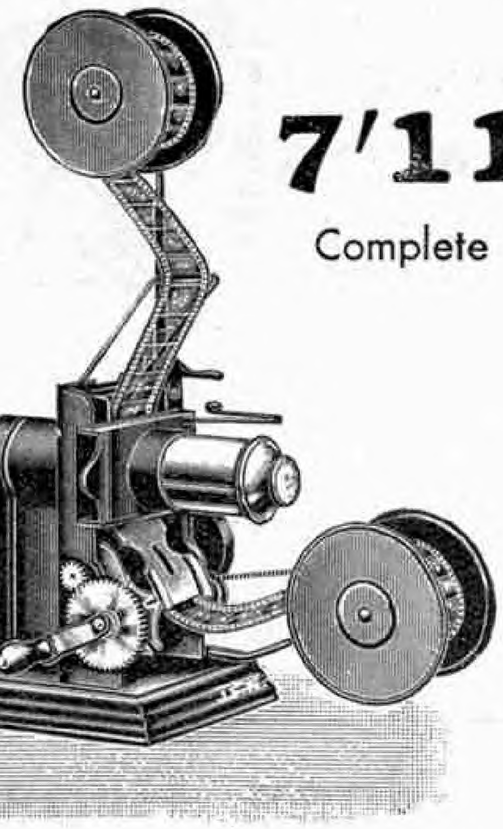
WINKLITE THE LIGHTING SET WITH A FLASHING REAR LAMP

Stocked by Halford's Cycle Depots and all leading Cycle Agents

THE INDCOL PLAYMATE CINEMA

FROM ALL DEALERS OR DIRECT TO:
DEPT. M., L. CONOLEY, INDCOL, 83/86, FARRINGDON STREET, LONDON, E.C.4.

Complete with FILMS, SLIDES, BATTERY and BULB.



7'11 Complete

For Extra Films and Slides, ask for List of Prices.

BE SURE AND SEE ON THE LABEL INDCOL PLAYMATE.

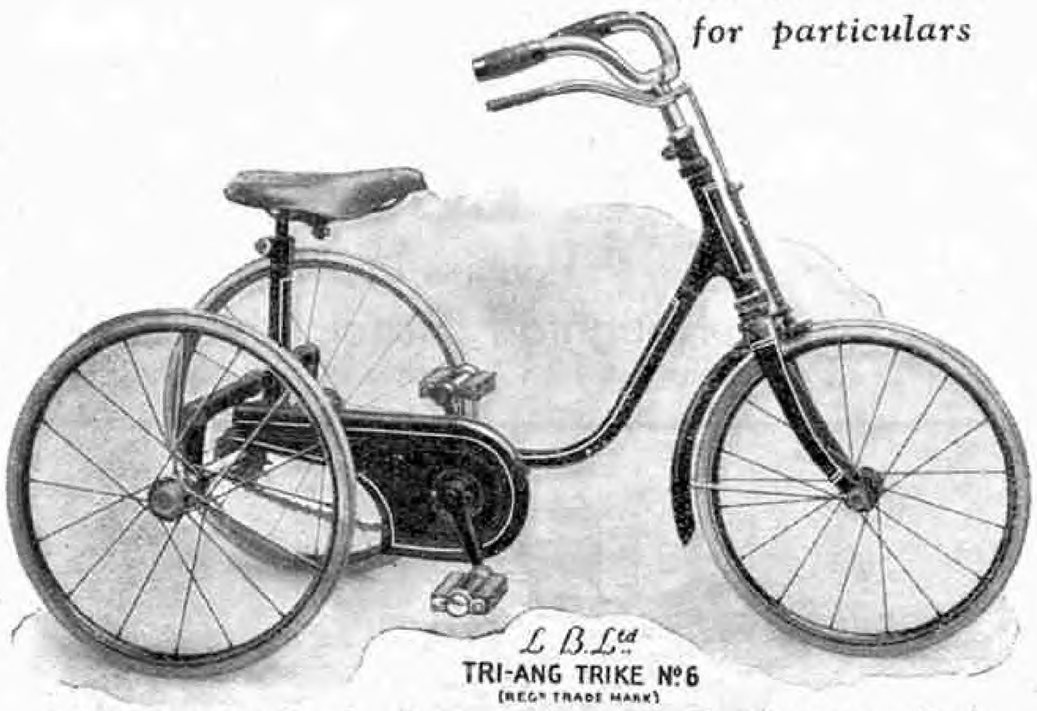
Tri-ang Toys *for Girls and Boys*

REGD TRADE MARK

Tri-ang Tricycles at popular prices

29/6 to 63/-

Ask your dealer for particulars



TRI-ANG TRIKE No. 6. A splendid tricycle, safe and strong. Frame of best quality steel tube. Roller chain and free wheel, plunger type brake, chain cover, adjustable saddle. Thick white sponge rubber tyres, 13 in. front wheel, 14 in. rear wheels. Price **39/6**

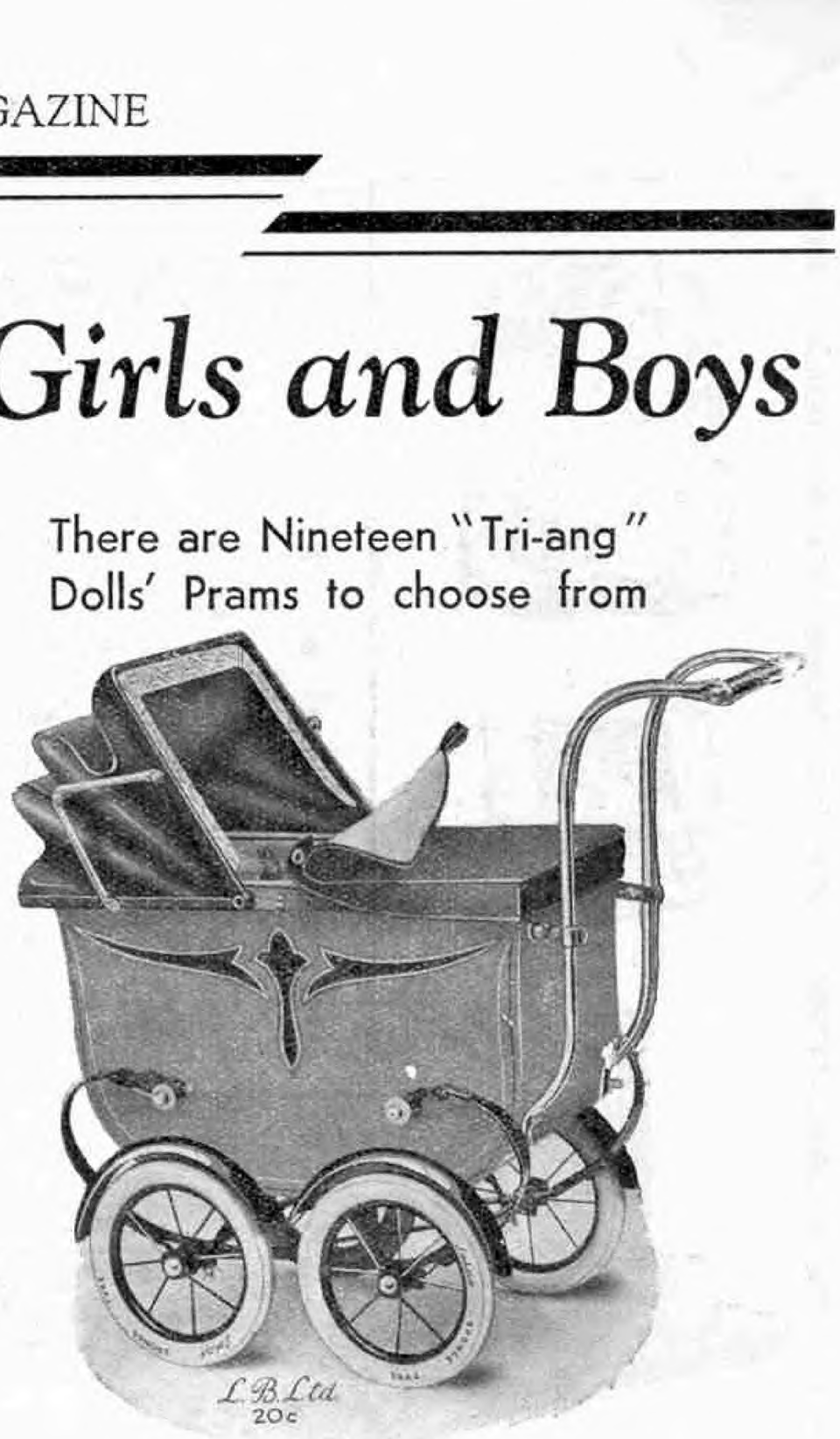


DOLL'S PRAM No. 26C. In every way the finest doll's pram on the market. A de luxe article at a popular price. The specification includes: All steel body with moulded sides, outside springs, 7 in. tangent spoke wheels, 1⅛ in. Solar tyres, rubber duck hood, apron and storm flap, all bright parts chromium-plated, chromium levers, four mudguards, laced hood. Size of body, 26 ins. long. Available in standard colours. Price **75/-**

Lines Bros. Ltd.

Tri-ang Works, London, S.W.19

There are Nineteen "Tri-ang" Dolls' Prams to choose from



DOLL'S PRAM No. 20C. A popular model with all steel body. The attractive design is moulded and tastefully lined. Best quality hood and apron, and chromium-plated handles. Two pairs dressguards and thick white sponge rubber tyres. Length of body, 20 in. Price **37/6**

"Fairycycles" (Regd. Trade Mark)

INSIST ON A GENUINE FAIRYCYCLE



FAIRYCYCLE No. 4. Made from the finest material, this Fairycycle will give many years' hard wear. Fitted with Dunlop pneumatic tyres and ball-bearings, rim brake, pump, tools, reflector, stand and carrier. Price **55/-**

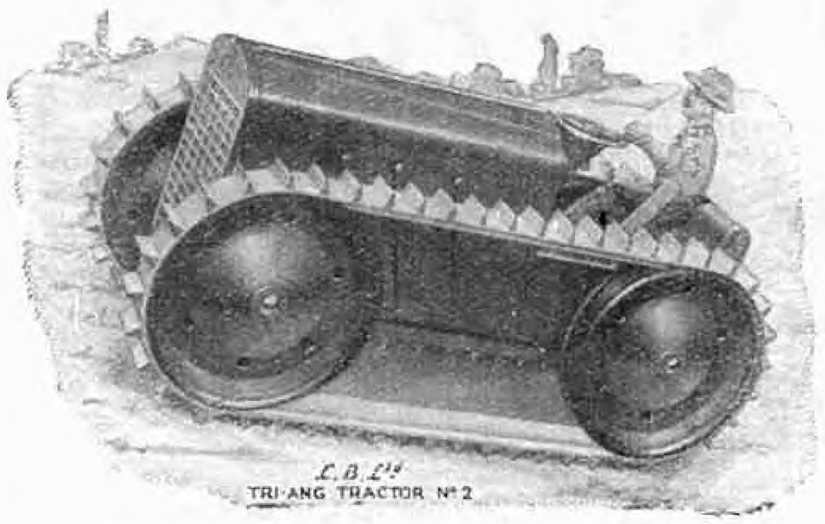
OTHER FAIRYCYCLES

No. 1	Model.	12 in wheels, ¾ in. Auto Tread Tyres	29/6
No. 2	,,	14 in. wheels, 1⅛ ,, ,, ...	39/6
No. 3	,,	as No. 2 but with chain cover and full equipment	49/6
No. 5	,,	Dunlop pneumatic tyres and full equipment ...	59/6
No. 6	,,	16 in. wheels and sponge rubber tyres	59/6

ON SALE AT ALL STORES AND TOY SHOPS

Insist on a Tri-ang Clockwork Toy

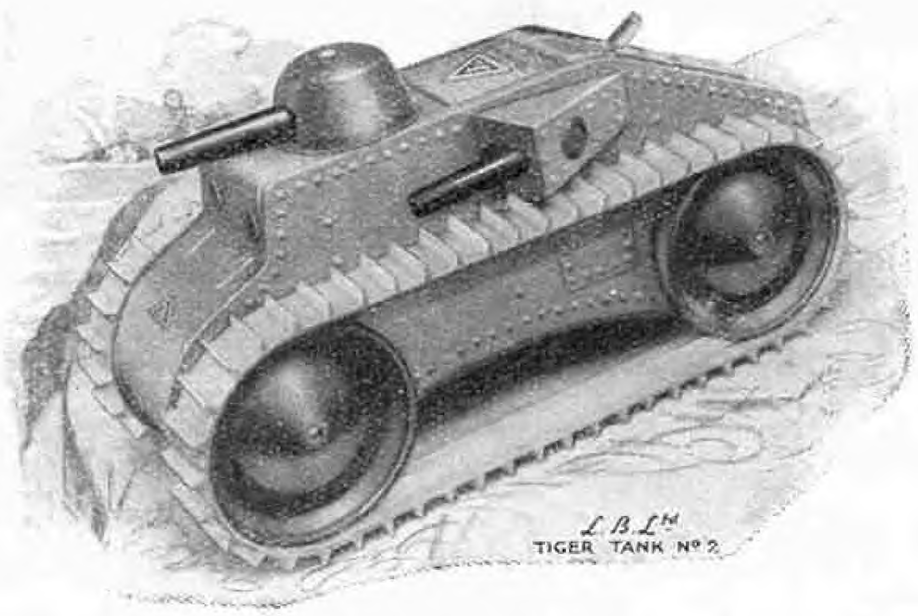
REGD TRADE MARK



L. BROS. LTD. LONDON
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ENGLAND

Regd. Trade Mark.

A splendid range of strong clockwork toys. Sturdily made and realistically finished. They will give you endless fun. See them at your local Xmas Bazaar or Toy Shop.

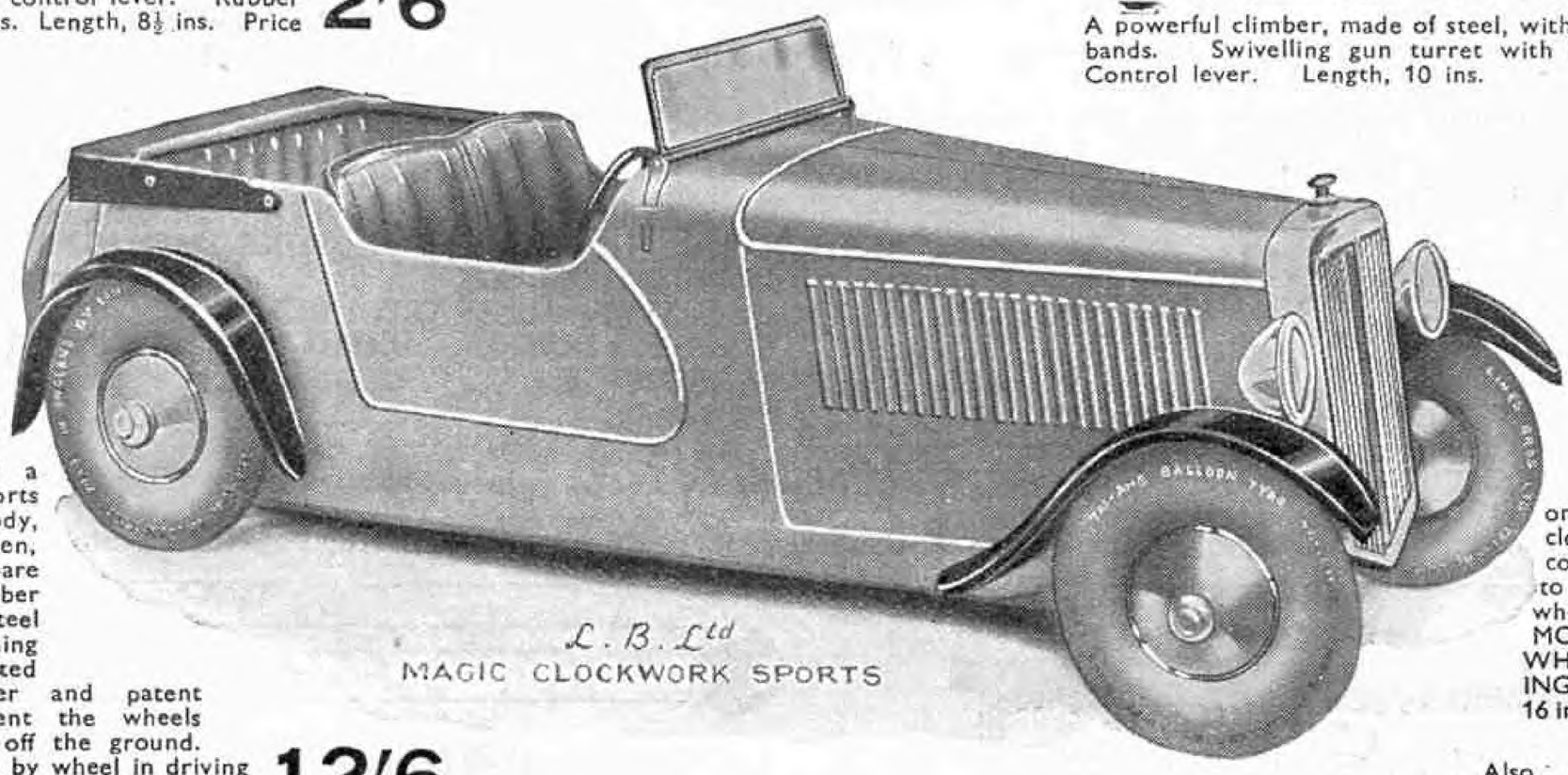


TRI-ANG TRACTOR No. 2

Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. Length, 8½ ins. Price **2'6**

TIGER CLIMBING AND FIGHTING TANK No. 2

A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever. Length, 10 ins. Price **4'11**



MAGIC SPORTS

A scale model of a modern 4-seater Sports Car. Strong steel body, adjustable windscreen, sports mudguard, spare wheel and tyre. Rubber balloon tyres on steel wheels. Long running clockwork motor fitted with control lever and patent governor to prevent the wheels racing when lifted off the ground. Motor type steering by wheel in driving seat. Length, 16 ins. Price **12'6**

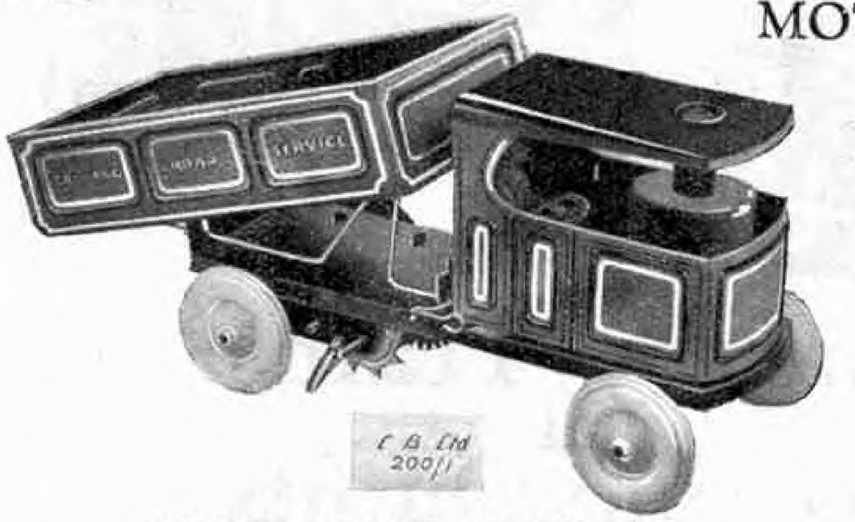
Also made with two electric lights and switch on dashboard. (Battery not included.) Price **16'-**

MAGIC SALOON
(not illustrated.)

This closed car is designed in the latest low built style and has very graceful lines. Strong steel body, sports mudguards, spare wheel and tyre. Rubber balloon tyres on steel wheels. Long running clockwork motor fitted with control lever and patent governor to prevent the wheels racing when lifted off the ground. MOTOR TYPE STEERING BY WHEEL IN DRIVING SEAT. Length, 16 ins. Price **12'6**

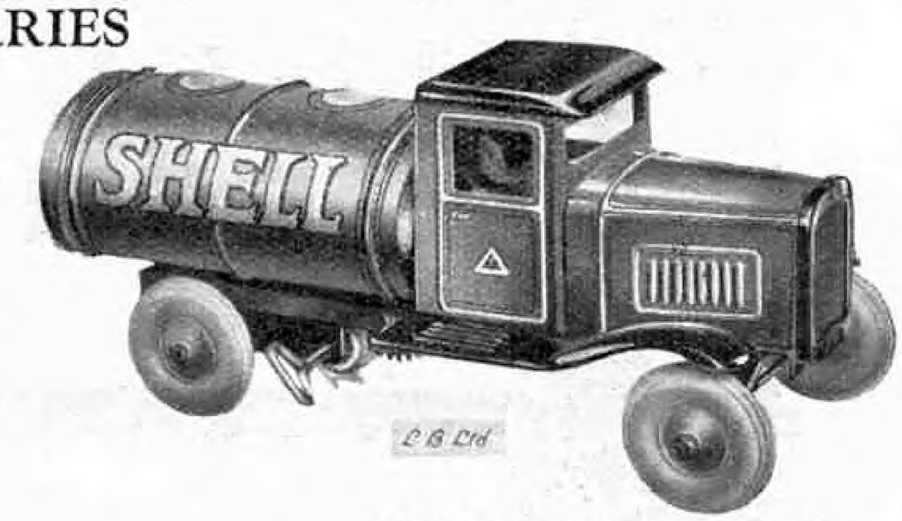
Also made with two electric lights and switch on dashboard. (Battery not included.) Price **16'-**

MOTOR & STEAM LORRIES



A popular series of well-known road vehicles. Strongly made with powerful clockwork mechanism, and finished in bright colours. All have SOLID RUBBER WHEELS.

Price 1'- each



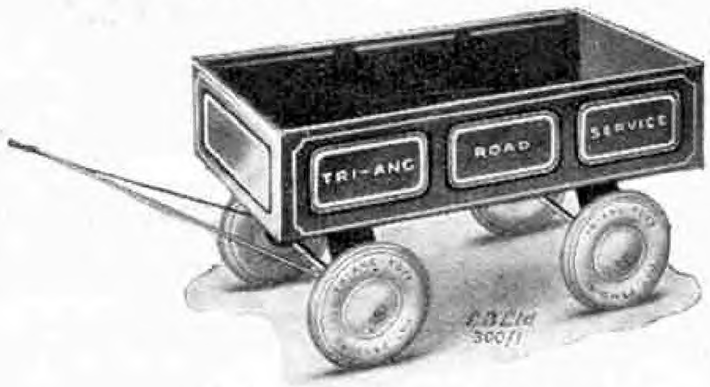
STEAM TIPPING LORRY
with tipping mechanism at side of cab.

STEAM DUST CART
with hinged flaps.

STEAM MILK TANKER
Realistic model of a well-known vehicle.

STEAM BOX VAN
with two doors at rear.

STEAM LORRY FLEET
Containing 4 different toys and trailer, packed in a strong box. Price **5'-**



Trailer. For use with any type in either series. **6d.**

MOTOR PETROL LORRY
nicely made toy lorry.

MOTOR BOX VAN
with two doors at rear.

MOTOR DUST CART
with hinged flaps.

MOTOR TIP LORRY
with tipping mechanism.

MOTOR LORRY FLEET
Containing 4 different toys and trailer, packed in a strong box. Price **5'-**

Lines Bros. Ltd., London, S.W.19



The CHELTENHAM FLYER Jig-Saw Puzzle

200 PIECES

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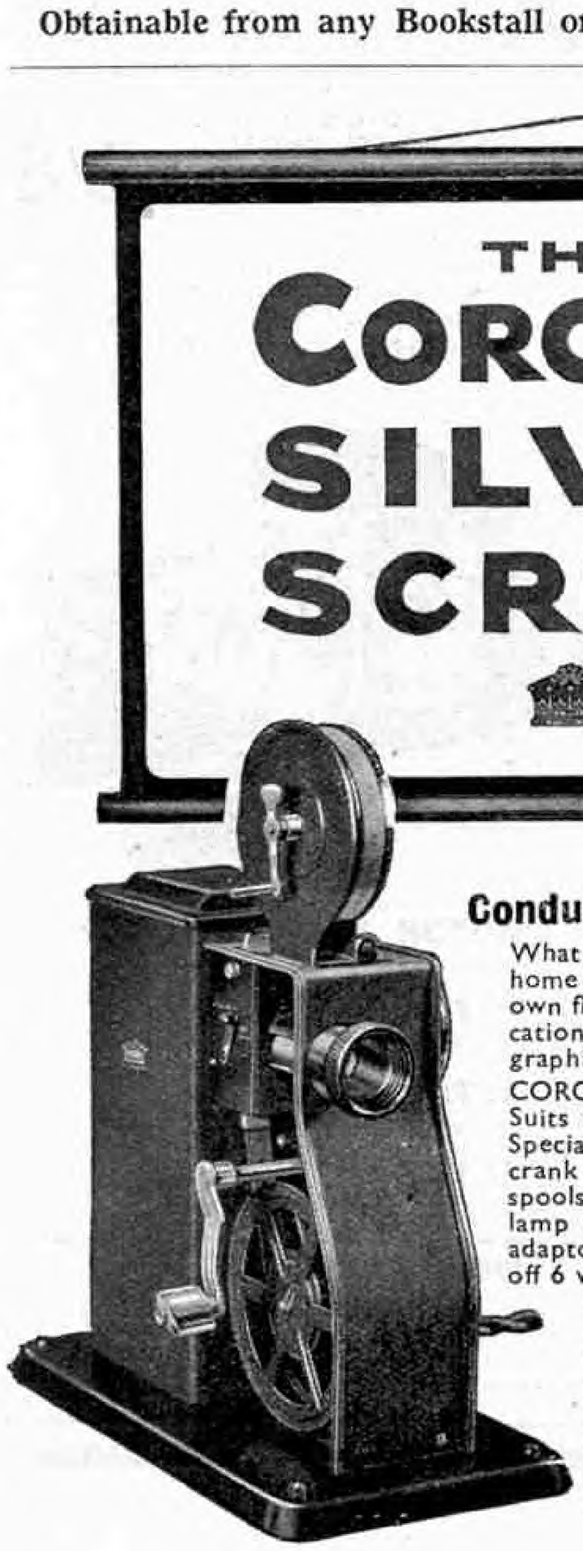
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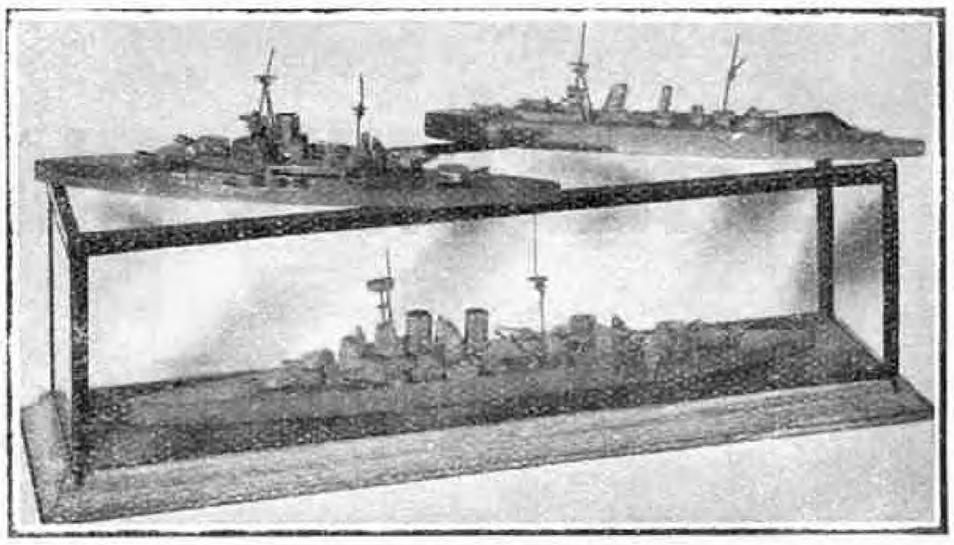
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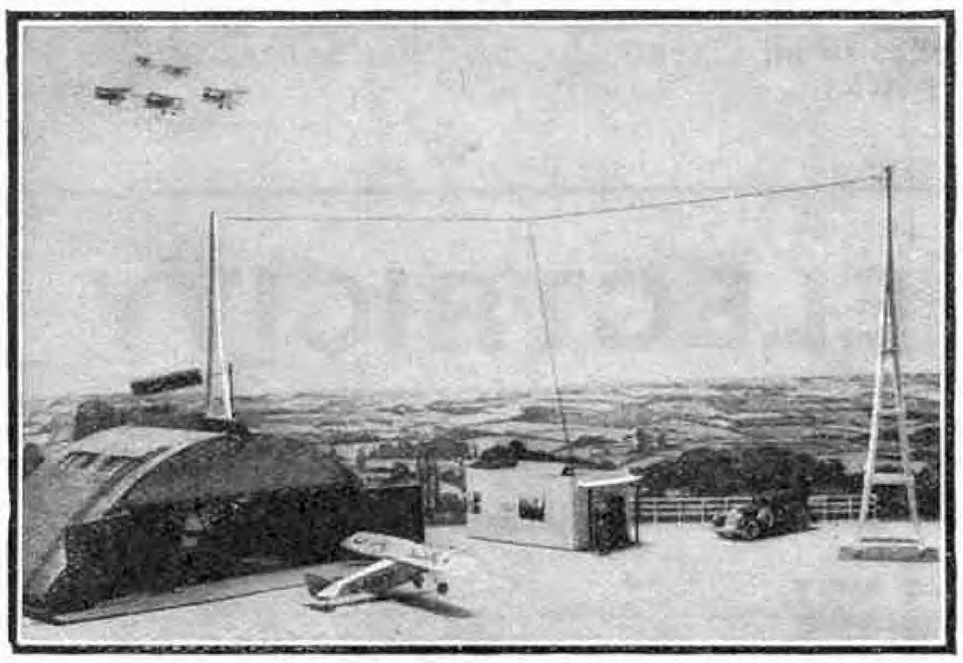
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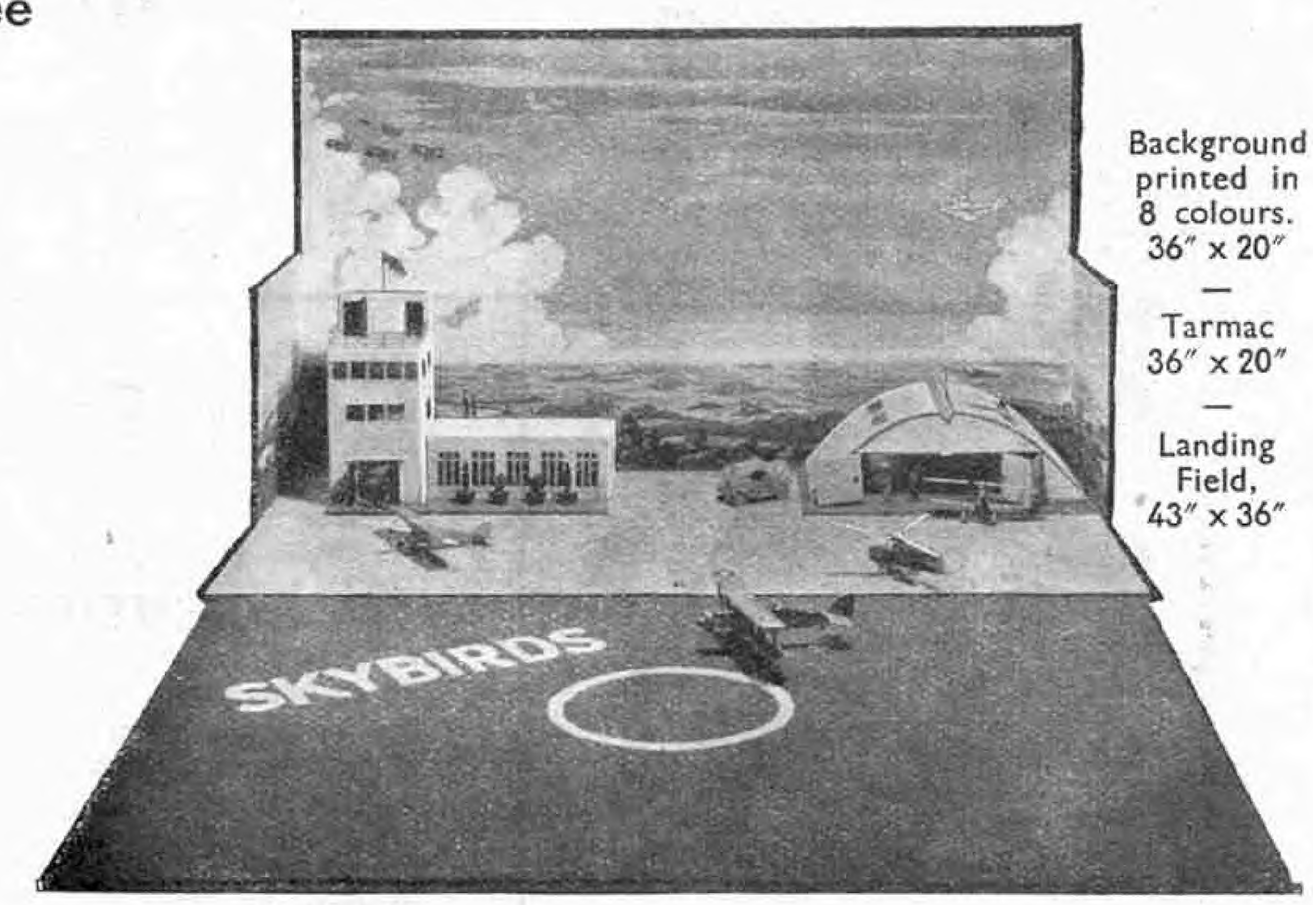
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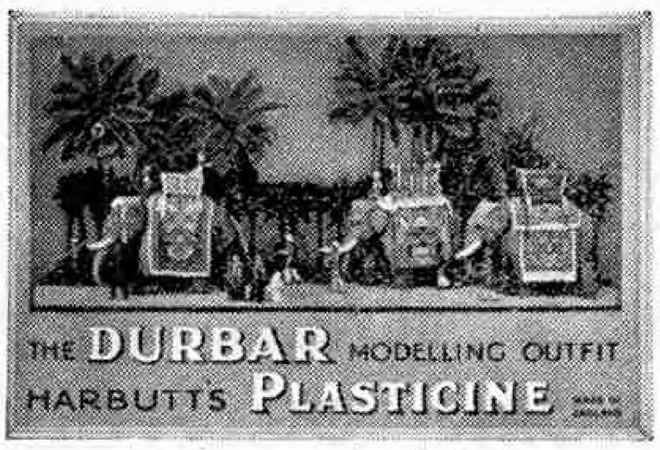
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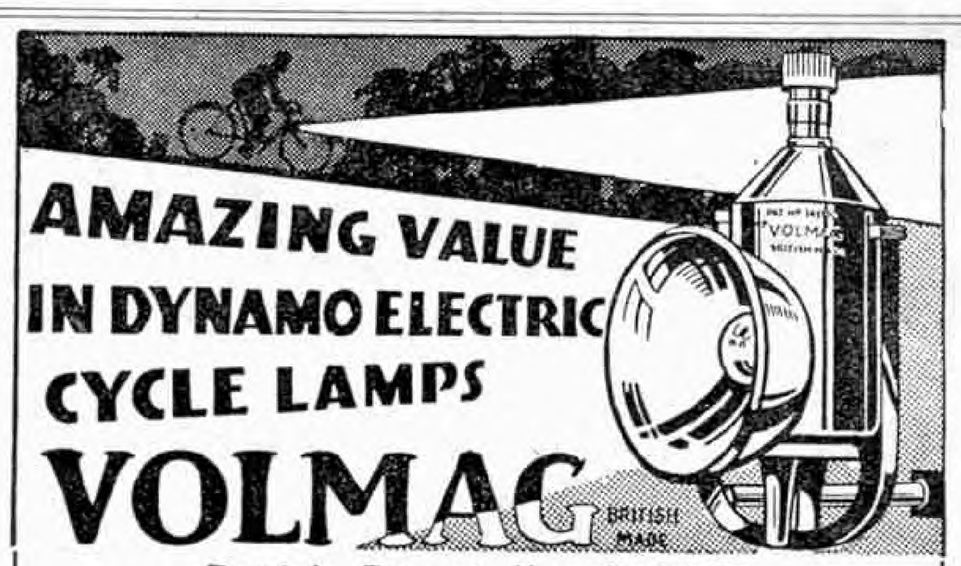


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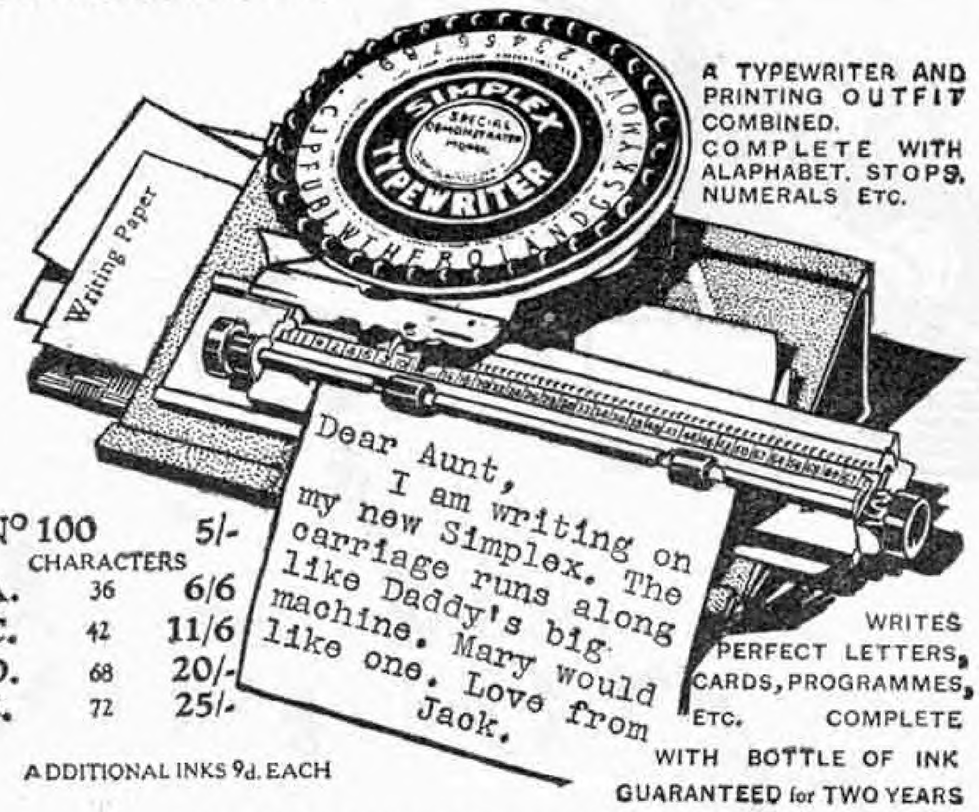
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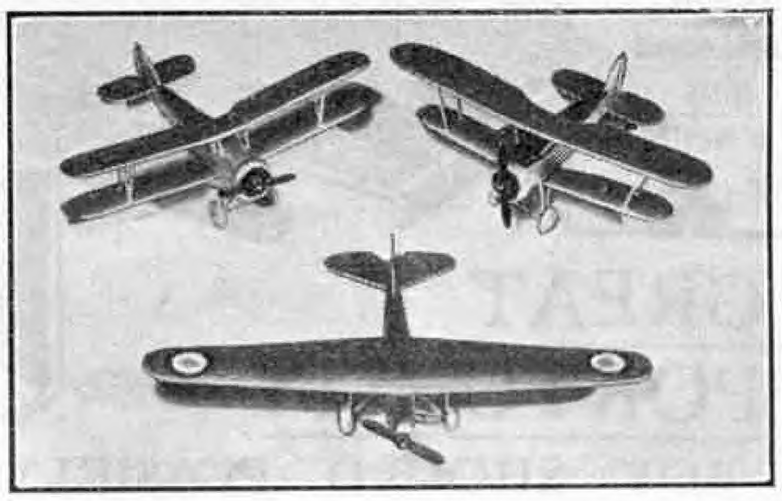
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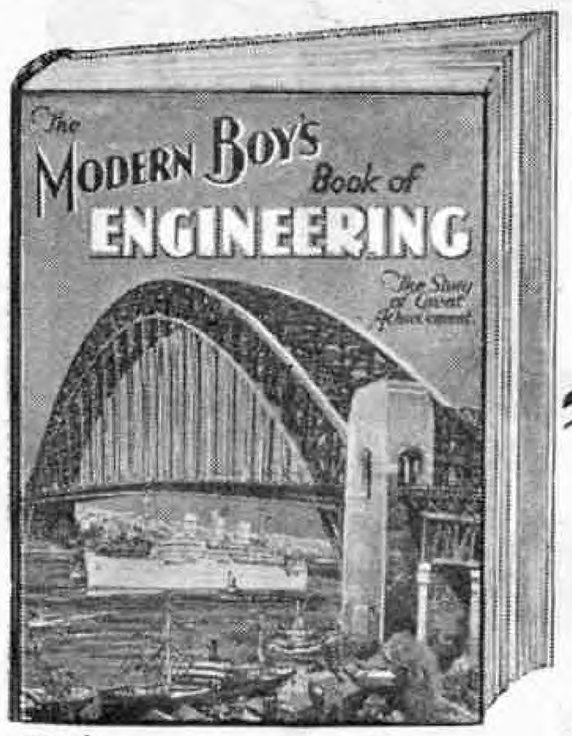
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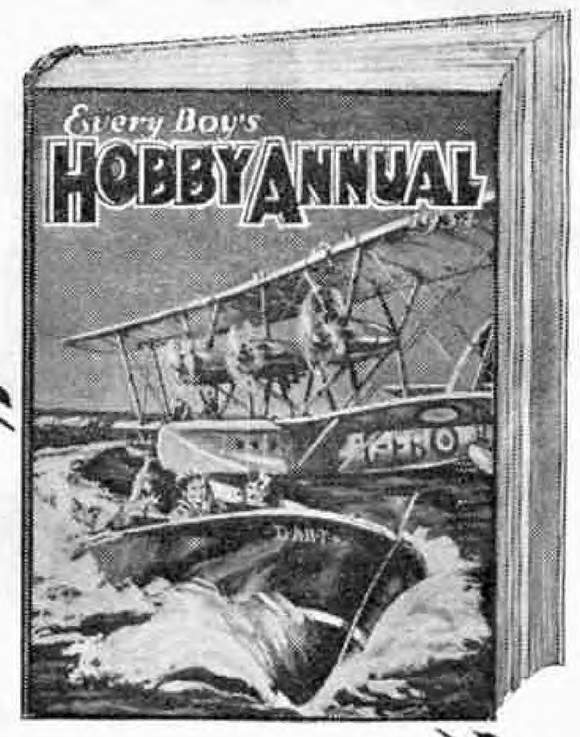
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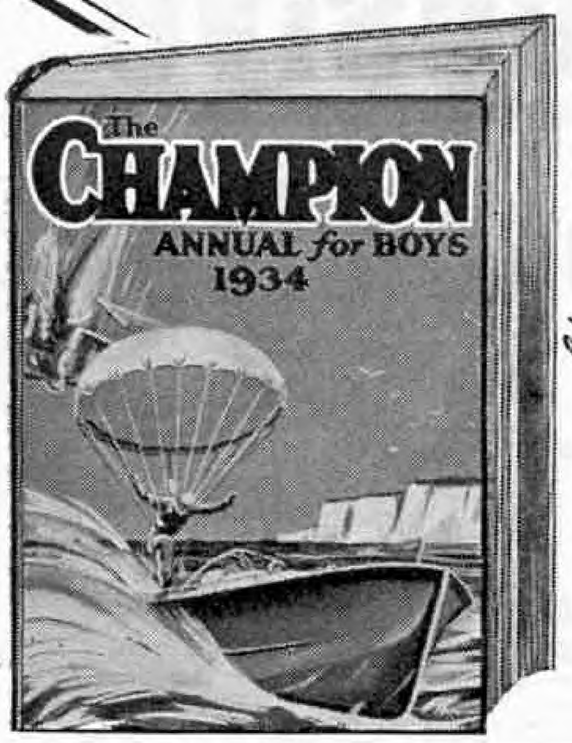
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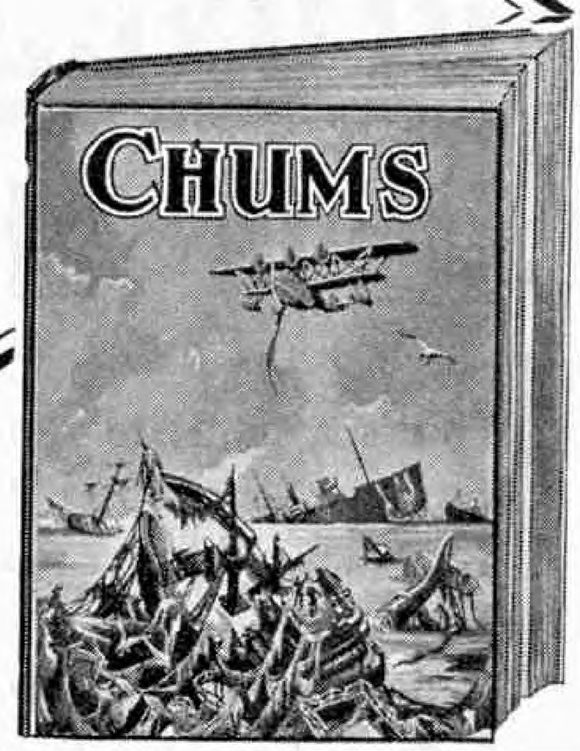
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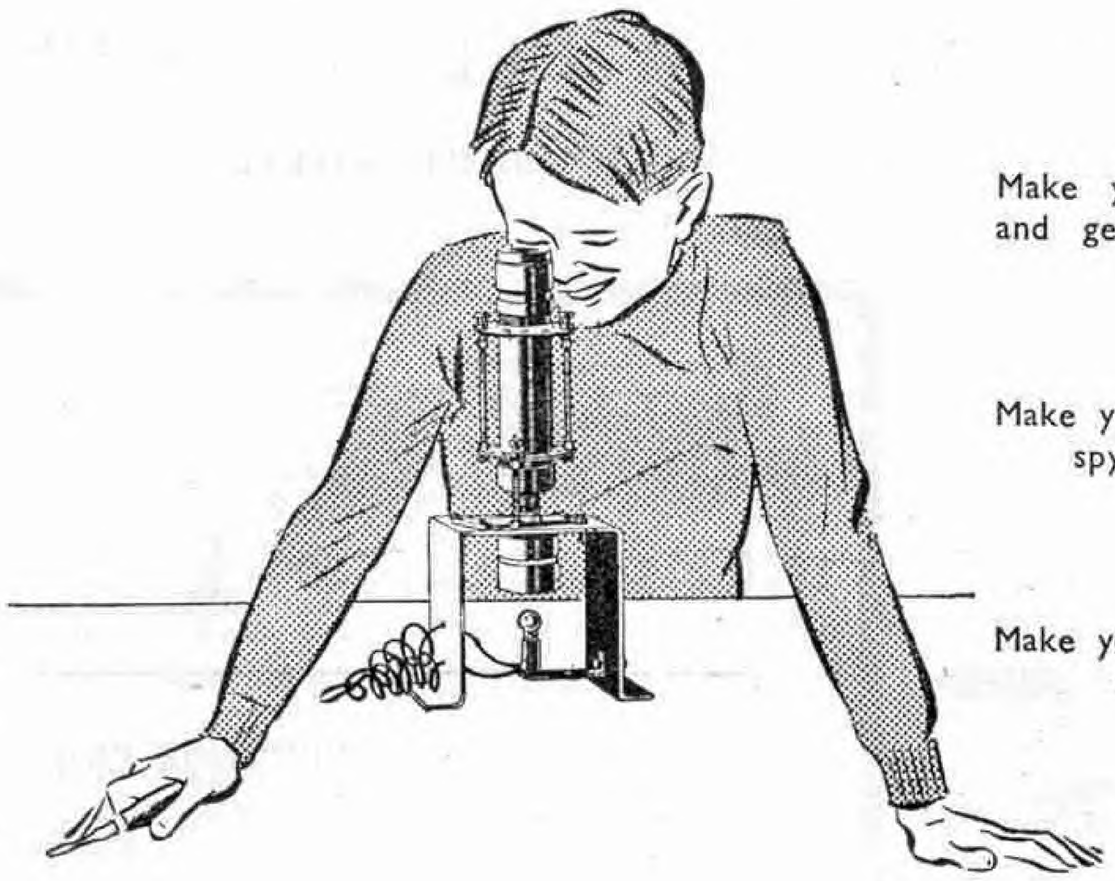
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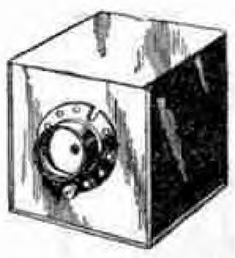
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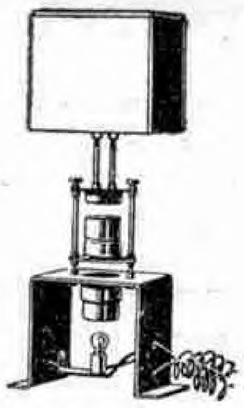
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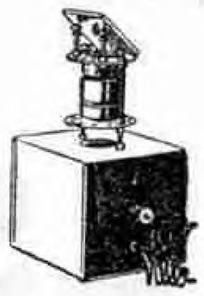
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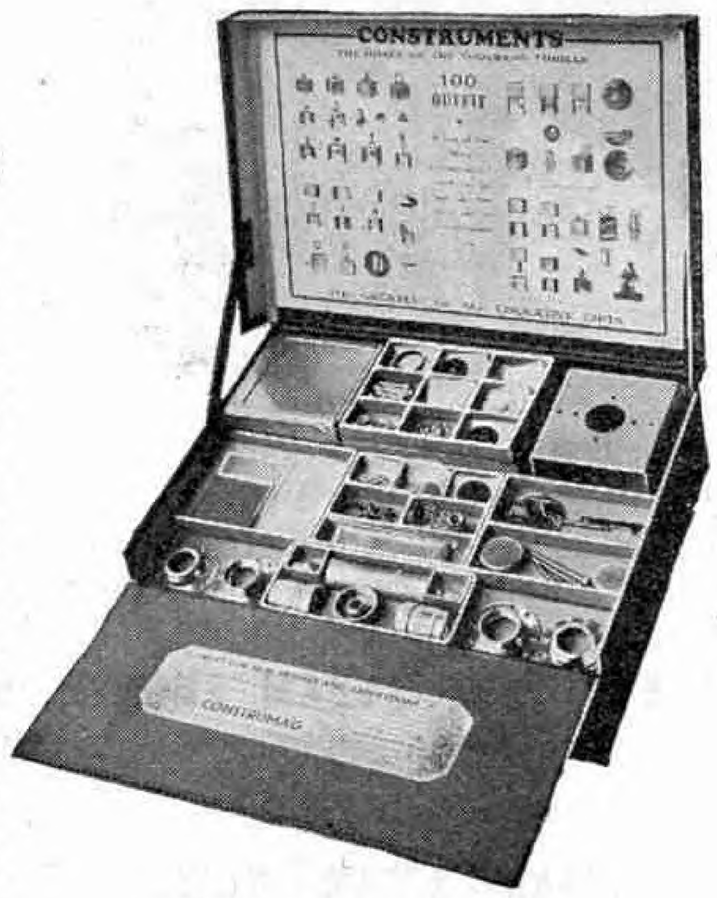
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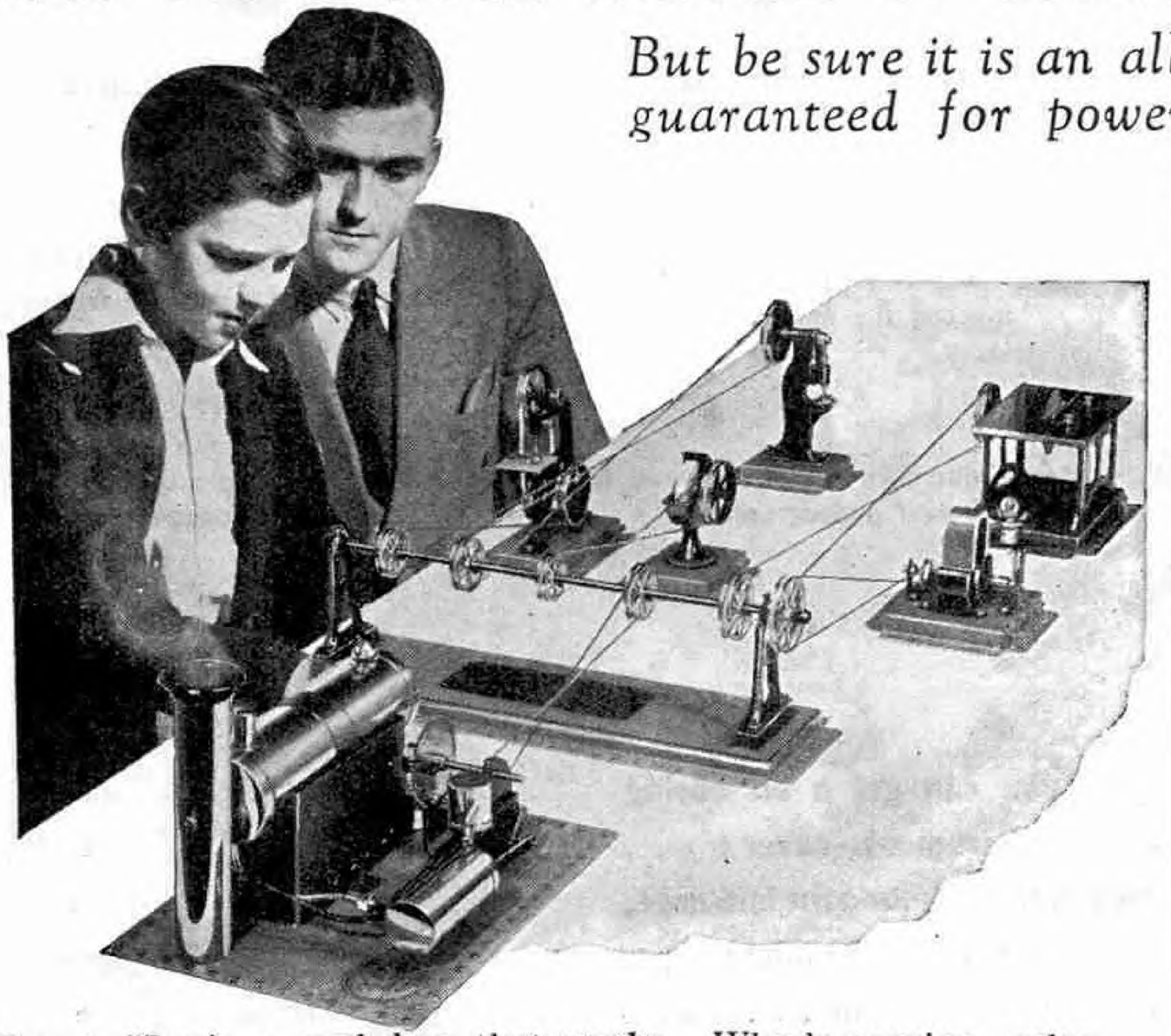
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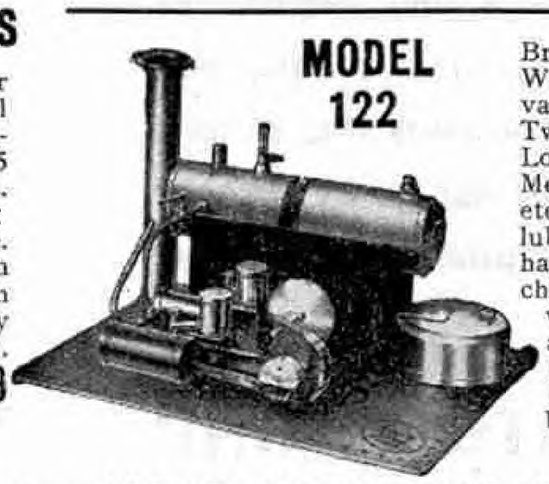
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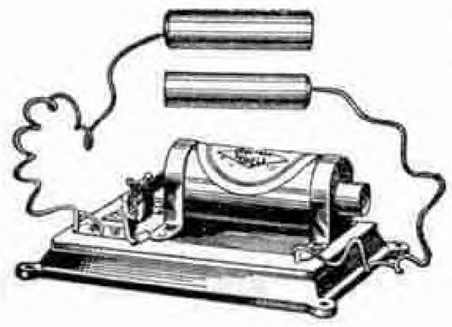
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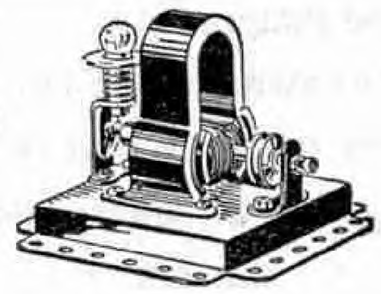
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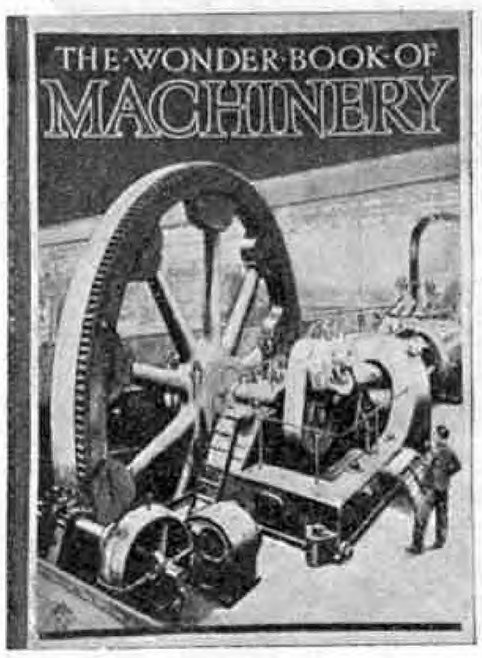
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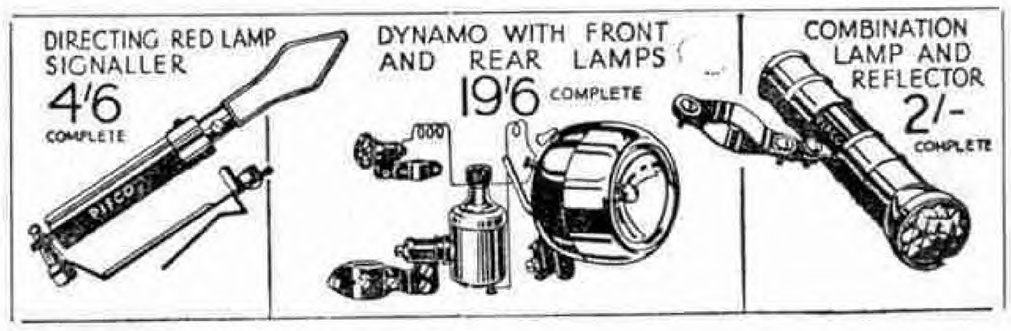
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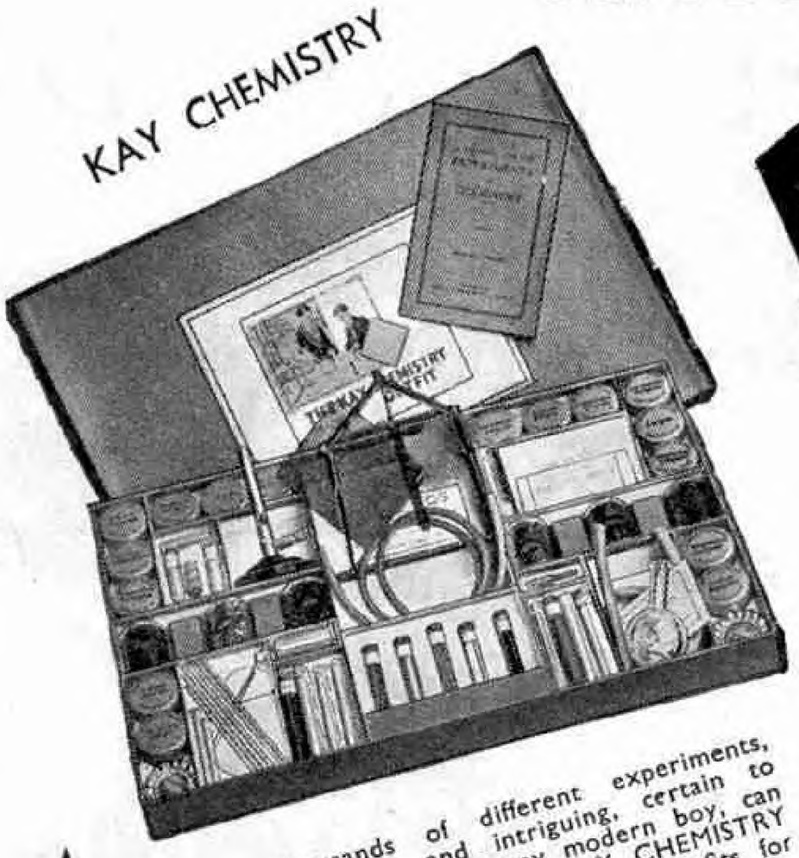
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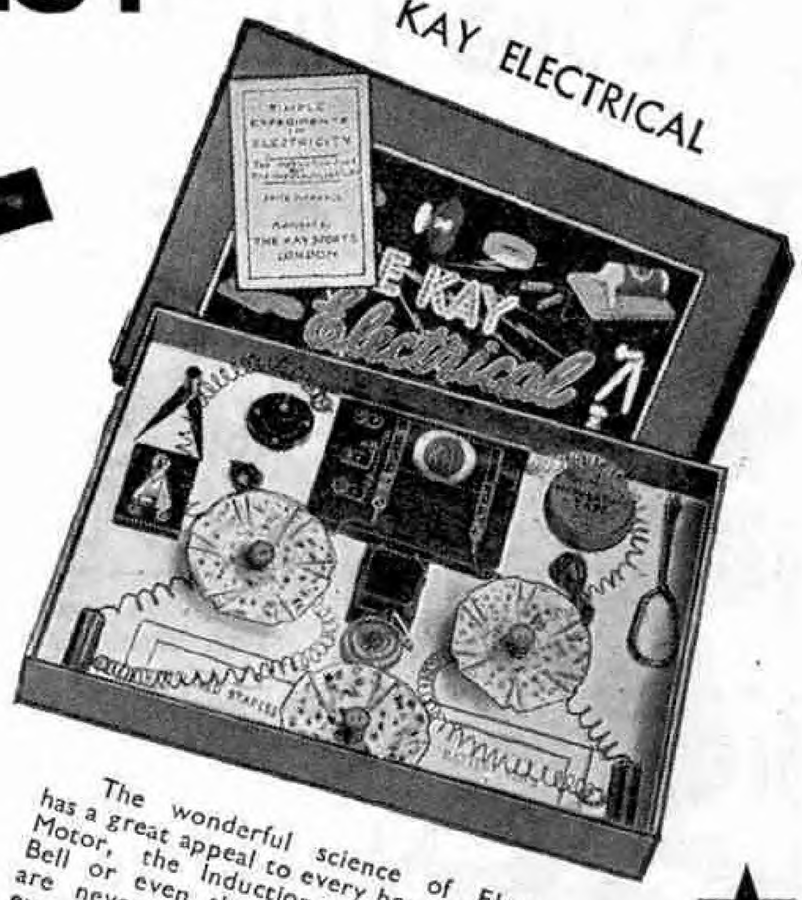
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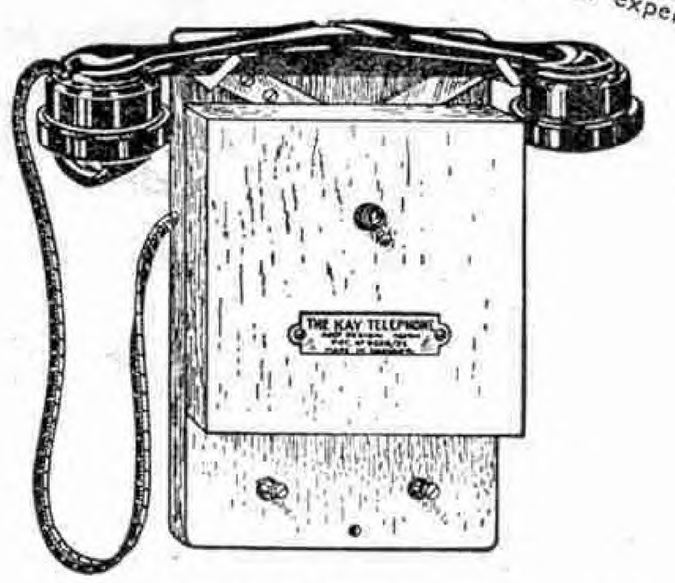
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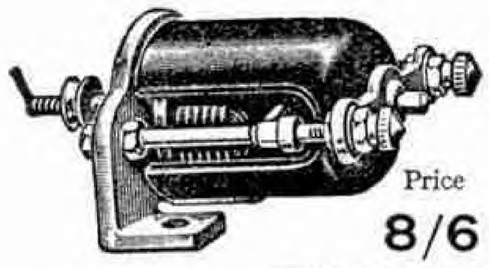
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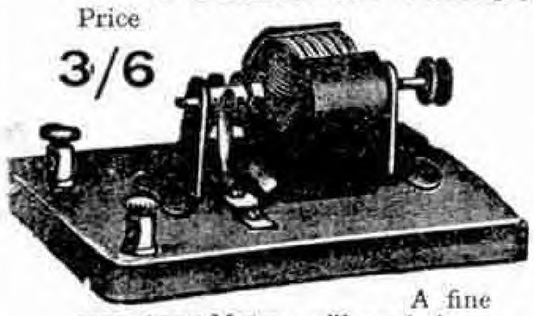
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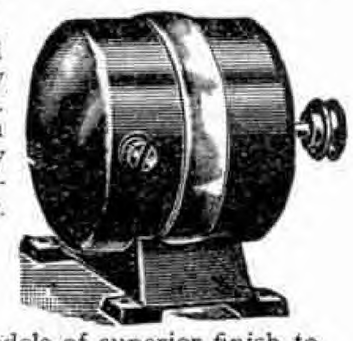
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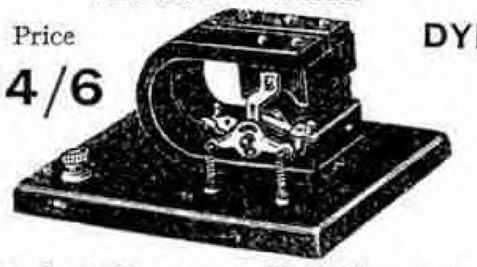
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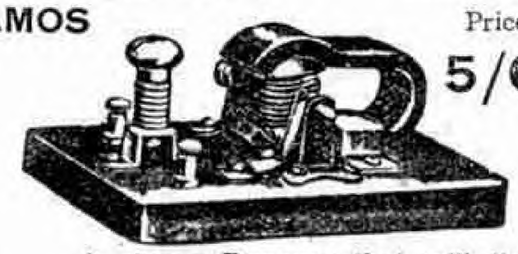


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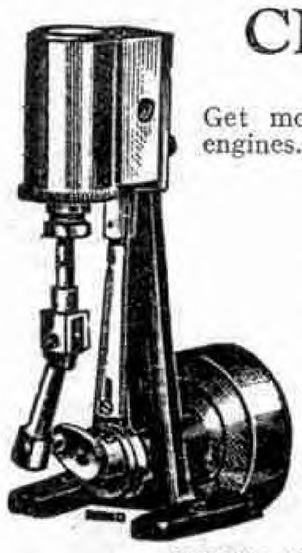


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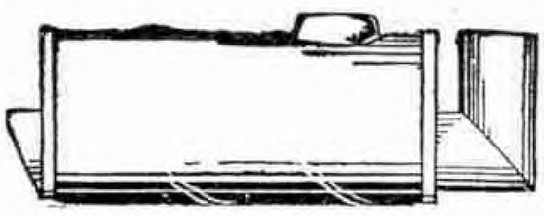


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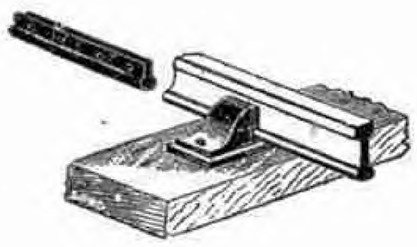


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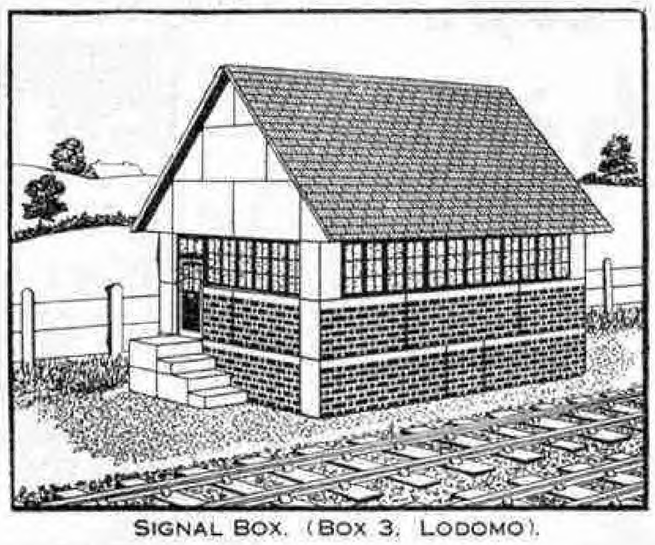
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SIGNAL BOX. (BOX 3. LODOMO).

LOTT'S BRICKS

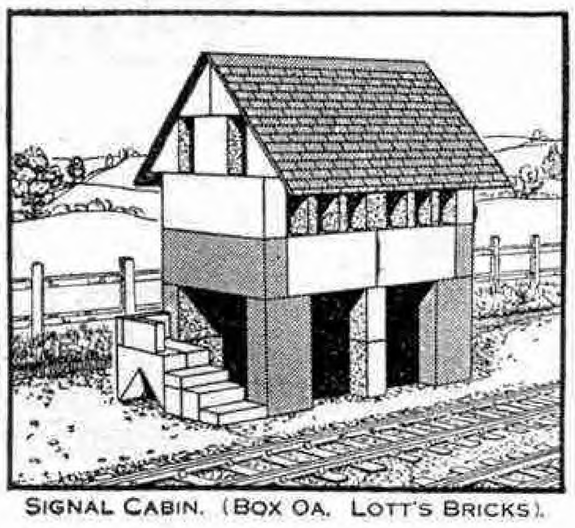
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LODOMO

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,, **0A.**	12 ,,	...	**3/3**
,, **1.**	30 ,,	...	**5/-**
,, **1A.**	12 ,,	...	**5/6**
,, **2.**	48 ,,	...	**10/-**
,, **2A.**	18 ,,	...	**10/6**
,, **3.**	72 ,,	...	**17/6**
,, **3A.**	(Supplement)	...	**7/6**
,, **4.**	84 Models	...	**25/-**
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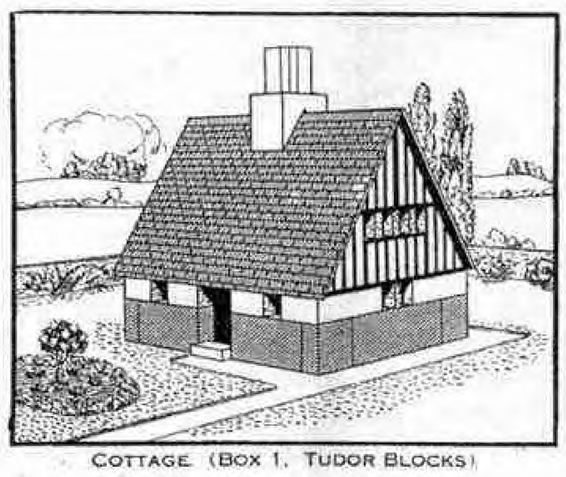
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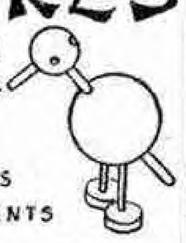
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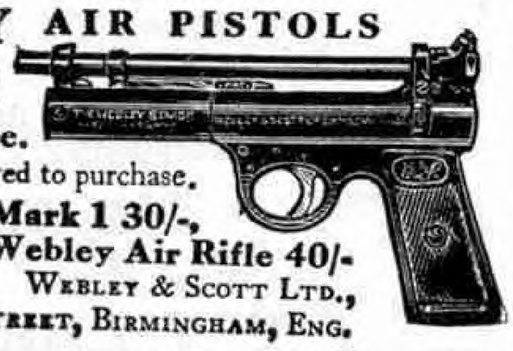
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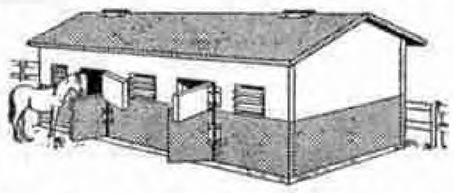
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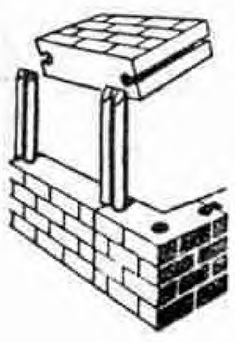
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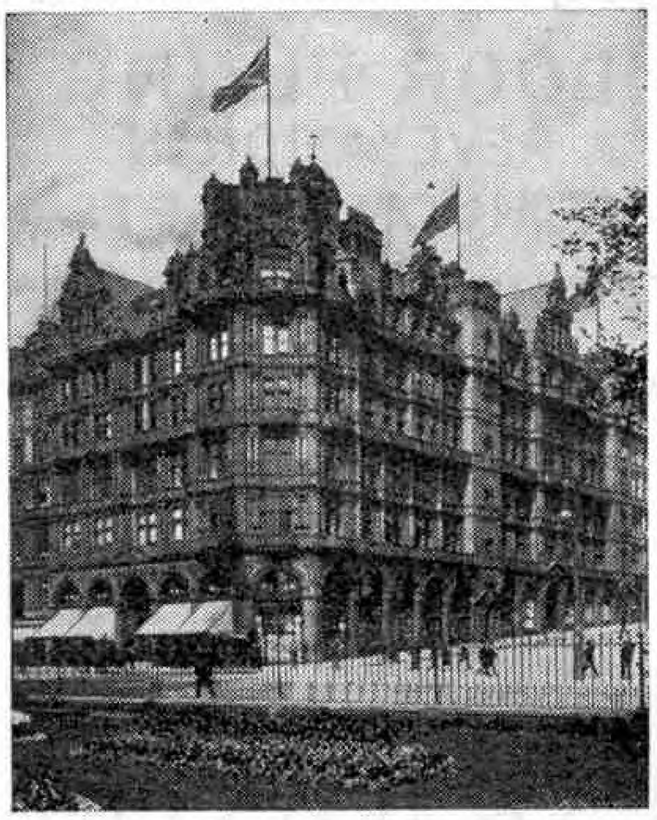
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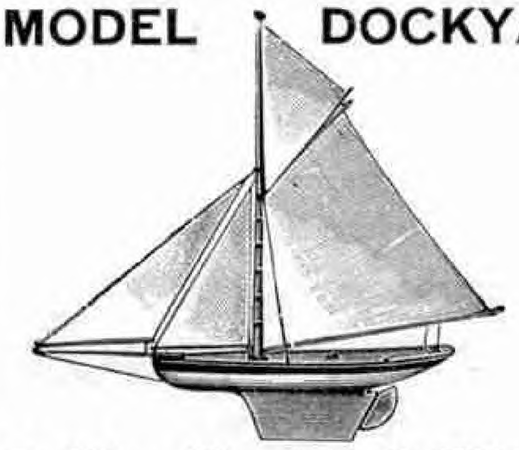
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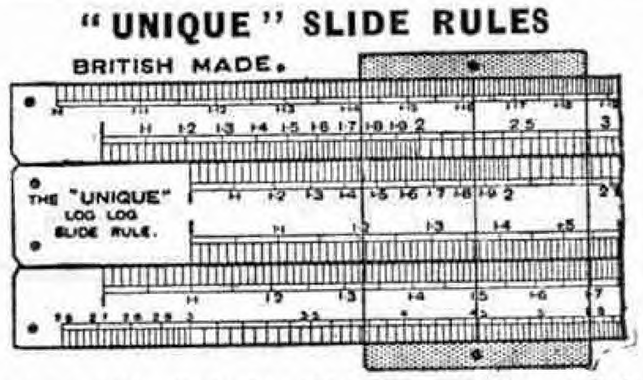
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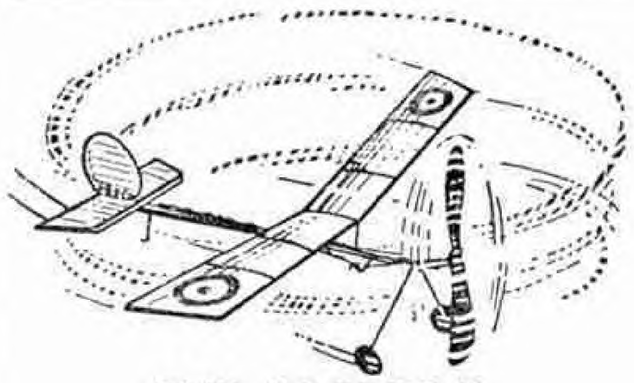
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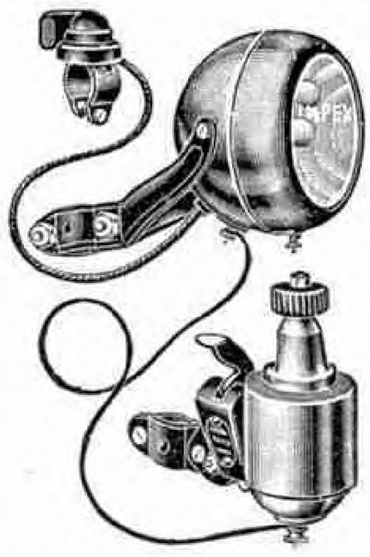
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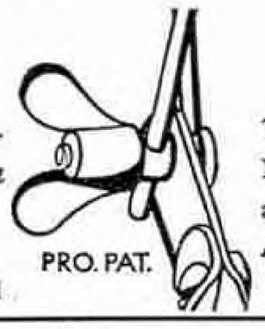
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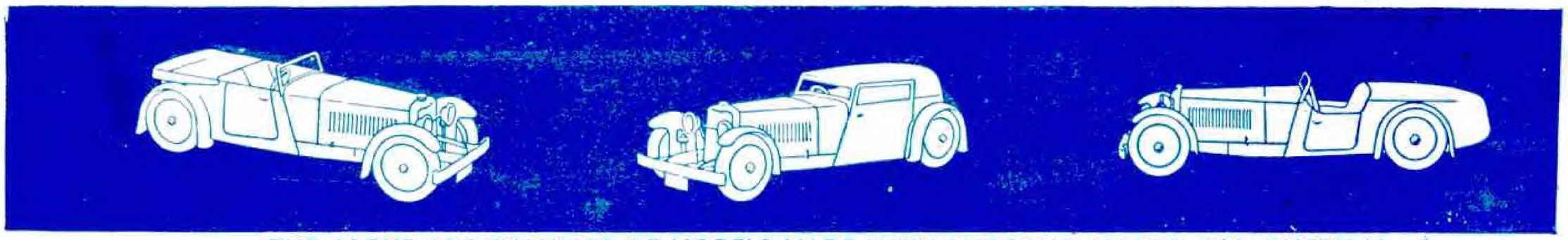
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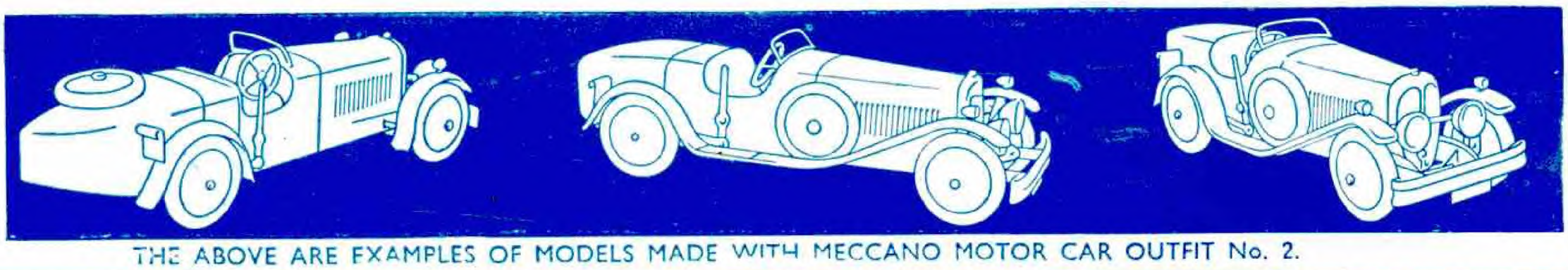
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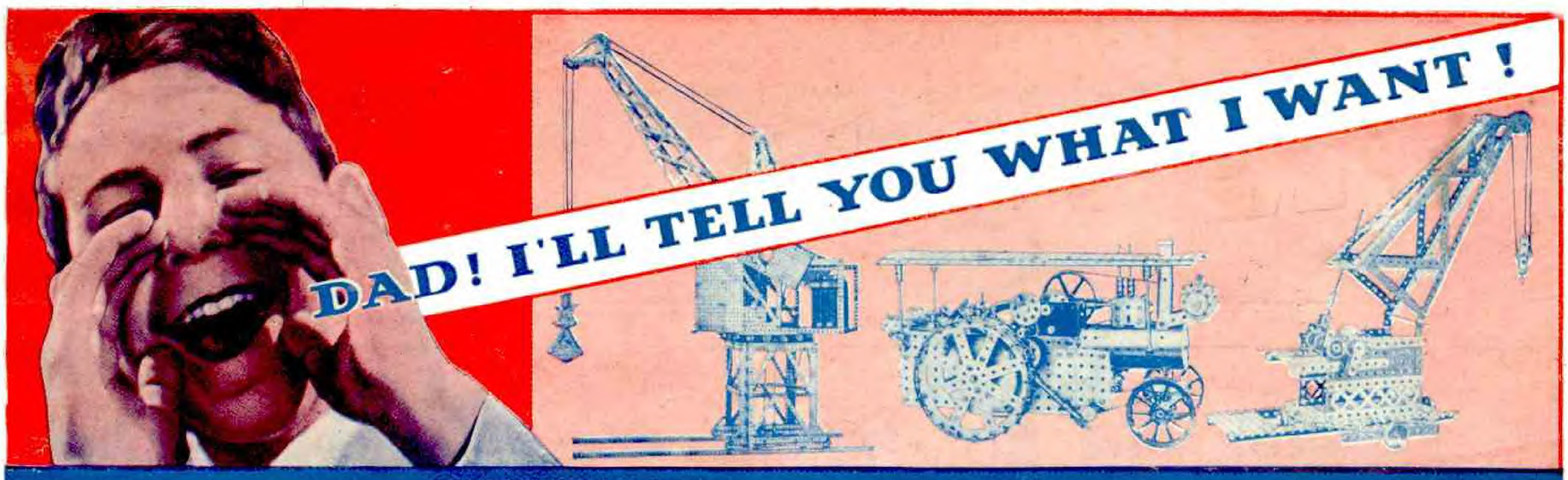
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